

COMPRESSED AIR

MAGAZINE

EVERYTHING PNEUMATIC.

Vol. XVIII

MARCH, 1913

No. 3

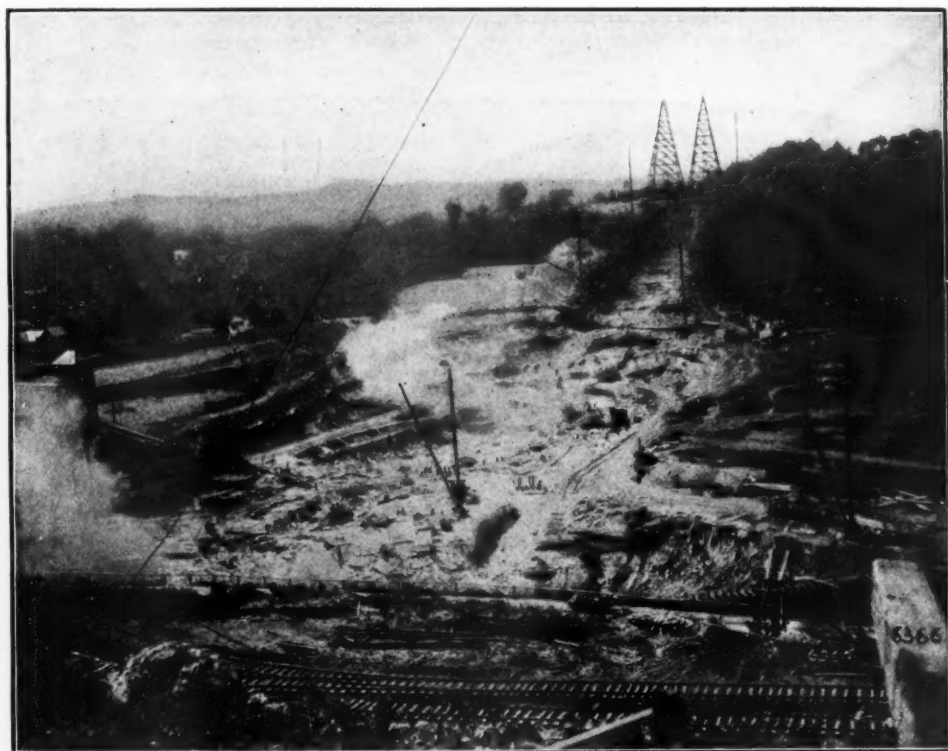


FIG. 2. SITE OF KENSICO DAM.

ROCK DRILLING AT THE KENSICO DAM

BY FRANK RICHARDS.

Great engineering undertakings, such as the building of the dam at Valhalla, N. Y., for the immense Kensico storage reservoir of the New York City water service, are now so familiar as to call for little description or remark in the current technical press, except for the fact that

most of these works have each some special feature of interest different from any other, and carrying some new lesson to the profession as to means and methods employed; and, as will appear, this is particularly true in the present instance.

Fig. 1 is a snapshot of the front of the dam of the old Kensico reservoir, which belonged to the original Croton system, the spillway,

which was the only rock-faced portion of the dam, having been cut away, its outline appearing at the left of the opening. This view was taken at an early stage of the present work.

The contractor for the new dam is H. S. Kerbaugh, Incorporated; Mr. B. R. Value is chief engineer, and Mr. B. C. Collier is assistant engineer. The contractors have been in charge since September, 1910, and they have installed a plant costing about a million dollars.

The general line of the dam is northwest and southeast. The structure will be 1,843 ft. long, about 300 ft. in maximum height, and

k. v. a. transformers which reduce the potential to 2,200 volts, which is used on the distribution lines. Pole-type transformers of either 488 or 244 volts are employed to furnish current to the machines.

The dam site is spanned by two 10-ton movable cableways, each of 1,860 ft. span, which have been installed not for the excavation but mainly to handle the new material of construction. The lower part of the dam will be built by travelers, four of these in a group facing each other across the 79-ft. space between adjacent expansion joints. The tracks for the travelers and for the cars bringing materials to the dam will be carried on con-

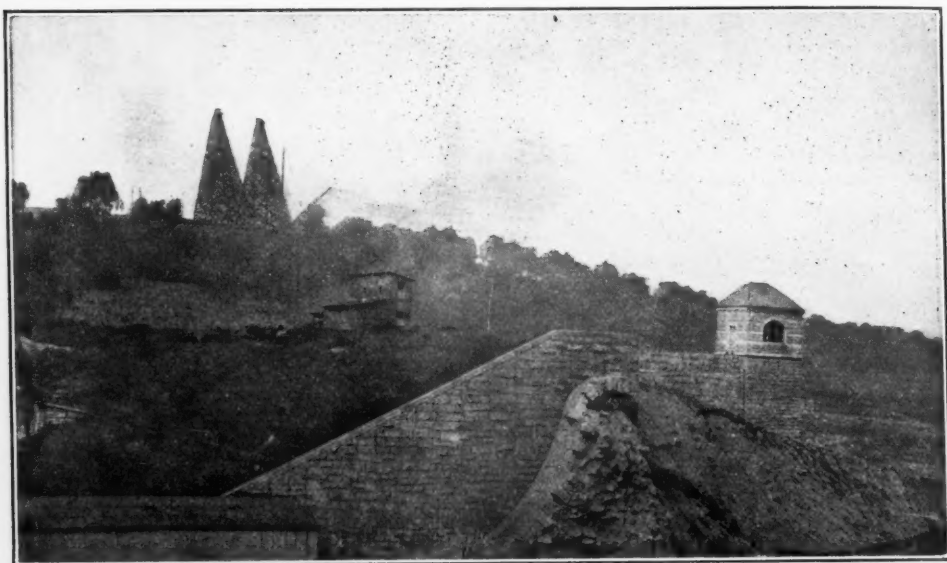


FIG. 1. OLD KENSICO DAM.

for 1000 ft. of its length it will be 170 ft. high. Just under the coping it will be 28 ft. thick. It will contain more than 1,000,000 cu. yds. of cyclopean concrete, and will have an upstream face of concrete blocks. The artificial lake which will be formed when the reservoir is full will be 30 miles around and the water stored will be equal to the total consumption of New York for some months.

Electric power is employed for all the apparatus except the steam shovels. The transmission line for the three phase, 60-cycle, alternating current follows the aqueduct right of way from Yonkers to a substation near one end of the dam site. Here there are six 667-

crete piers. Each traveler will have two derricks, which will each be equipped with 75 h. p. Maine electric hoists geared to handle 16 tons at 45 ft. per min. or 6 tons at 115 ft.

Fig. 2 is a general view of the dam site in the earlier stages of the work with not more than one-half of the excavation accomplished, and that at the southeastern end of the site, behind the spectator, scarcely begun. The farther bank, as will be seen, has been cut into at the top to give the dam a secure abutment at that end, and the excavation has proceeded from there downward and along the base of the dam. The work of erecting the dam can begin at the one end before the completion of



FIG. 3. GROUP OF ELECTRIC AIR DRILLS.

plan adopted here was to drill a great number of vertical holes, all bottoming at a common level, to load these with high explosive and to fire a great number of the holes at once, thus the excavation, and with the work in full swing both operations may proceed simultaneously without interfering with each other.

It will easily appear that the most important and responsible mechanical agency in the execution of the work is undoubtedly the rock drill. Upon it devolves the task not only of cutting away the rock which at present occupies and encumbers the site, but also of cutting out of the solid bed practically all the rock material which is to constitute the new

dam structure. For the work of excavation a number of standard Ingersoll-Rand percussion, air-driven drills have been employed, the air being supplied by two electric driven compressors.

For the more responsible work of supplying the new rock material for the dam a site for a quarry has been selected about half a mile east from the southeast end of the dam, the rock which is clean and flawless being classed as a gneissoid granite. The original surface of this quarry site was covered with second growth timber which was cut off, and when the soil had been removed the glacier-scored surface was exposed as seen in our views. The



FIG. 4. ROCK SURFACE WITH DRILLED HOLES.

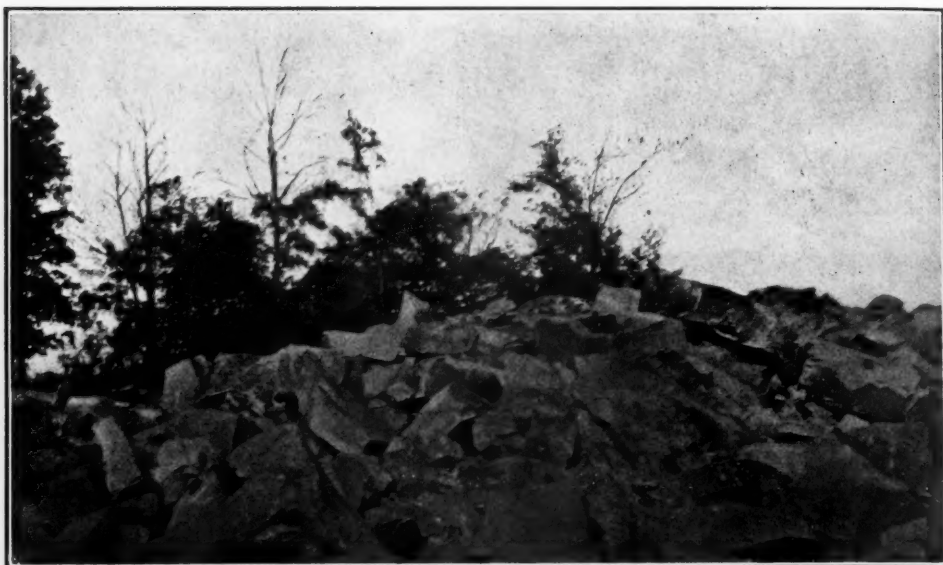


FIG. 5. AFTER THE BLAST.

breaking up the material so that it could be easily removed by the steam shovel.

For this drilling Electric-Air drills are employed, the entire contract calling for 30 of these machines. It must strike one that the drilling conditions are quite favorable here, or, it might be said, the rock drillers job would seem to be a comfortable one. The surface affords a good and almost level footing for the tripods, there are no obstructions in moving from hole to hole, and the drills employed have certainly "made good." When the photos were taken each drill was operated by two men putting down two 20 foot holes for the eight hour shift.

The drill and tripod weigh less than air-driven rock drill of equal capacity, and they are easily moved from hole to hole—six feet—while the pulsator apparatus is handled almost as easily as a baby carriage, and it is to be remembered that there is no expense or labor required for laying and extending air pipes. The stringing of the wires along the ground comprises the entire power connection between the drill and the power house. Figs. 3, 4, 5 tell the story of the quarry operation. In Fig. 3 we see a group of electric air drills at work; Fig. 4 shows the quarry surface after the drilling, each hole being made conspicuous by the wooden plug which has

been inserted, and Fig. 5 shows how the rock looked after some 1,200 holes had been fired all at once.

THE DRILL WAGON.

Besides the tripod electric air drills there are also four electric-air "drill wagons" on the job. One of these is shown in Fig. 6. It carries an electric-air drill of larger size, putting down larger and deeper holes. This machine is entirely self-contained, and is moved along upon a temporary track as the work proceeds. The drill has a vertical power feed of 6 feet, traveling up and down the vertical guides at the right, while the lighter and higher frame at the left is for a power hoist for the steels, taking them out of the hole at a single lift, except for the last steel or two when the holes are getting down to the depth limit.

THE DRILL SHARPENER.

Quite a change in drilling practice generally has resulted from the advent of the mechanical drill sharpener. It is no longer the best practice to try to get as much work as possible out of the steels before sending them to the blacksmith for redressing, and there is no longer any thought of saving blacksmith work. The machine does the work so much quicker and so much more effectively and precisely that it

is difficult to make comparisons. A Leyner drill sharpener is maintained in connection with these drills and a mule is constantly employed in "snaking" the steels back and forth. The steels are kept constantly in the most effective working condition, the gage for each steel is maintained precisely and the reduction of bore for the successive steels is minimized where that feature is of any importance.

While the electric-air drills in use here have had the full benefit of the drill sharpener service they are concededly a pronounced success independently of that. They were not adopted at all as an experiment but upon reliable evidence in advance as to what they could do; and they are doing it.

The electric air drill proves itself to be the full equal, and a little more, of any air operated or other drill of the same capacity; that is in drilling holes of the same diameter and depth in rock of the same character. It strikes a sharper blow, its blows are timed to a uniform and constant rapidity, it avoids sticking in the hole, so that in a day, or any other given time of sufficient length, it shows as much accomplished, or a little more than any other type of drill can show, and in comparisons as to actual performance it requires no allowances or concessions of any kind. The cost of maintenance of each drilling outfit—drill and pulsator—is no more than that of the air drill. The simplicity of the drill unit and its little liability to wear or accident balances the repair and maintenance of the pulsator part.

The electric air drill complete costs more than the air driven drill taken alone, but the air drill, with its share of the compressor which drives it, and the piping and appurtenances, costs much more than the electric air drill, and for mere first cost when installing a plant the latter shows a great advantage. The piping and appurtenances alone for the air drill will more than cover the excess of cost of the electric air drill, and then we might say that there is the cost of the big air compressor plant on the one side and that of the electric generator plant upon the other; but in so many cases, like the present, the generating plant costs nothing, because current can be furnished by the big electric companies cheaper than it could be produced by any isolated plant.

POWER COST OF ELECTRIC AIR DRILLING.

But the most interesting and really the most

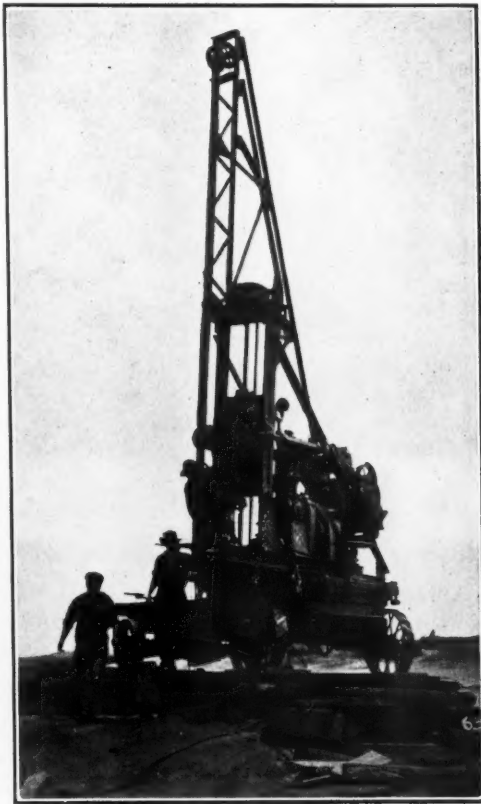


FIG. 6. ELECTRIC AIR DRILL WAGON.

important question in regard to work of the extensive and protracted character here involved is as to the power consumption and the total cost of operating. Here we have results which can only be characterized as astonishing.

First, as to the drill wagon. The one seen in Fig. 6 has been in service four months. It is drilling holes to a maximum depth of about 30 ft., using a 5 or 5½ in. starter and bottoming at 4 to 4½ in., the average depth of holes for 8 hrs. ranging from 45 to 65 feet. Under test conditions 104 ft. of hole has been drilled per shift.

Any comparison between the performance of this drill and the standard churn or well drill must be based more or less upon assumption, as no well drill has been actually operated in the same rock alongside this apparatus. Competent experts, however, state that the standard well drill could not drill this rock at a rate of more than 10 ft. per shift. Under the best conditions the cost with the well drill

would average between \$0.80 and \$1.00 per foot. The actual cost per foot obtained on the electric pneumatic drill wagon is made up as follows:

Electric Power for 8 hours.....	\$0.60
1 Drill Runner.....	4.00
Helper	2.50

Basing the cost per foot upon the power and labor charges alone and considering the average daily work as 50 ft., which is very conservative, would bring the cost per foot to approximately \$0.14. With a driller representing the builders of the drill this cost was cut in half and it is believed that when the three other machines also are drilling and the usual rivalry develops between the crews the drilling capacity will go up materially, probably from 60 to 75 ft. per shift, and this would bring the cost per foot for power and labor to \$0.10 or less.

The wagon is as readily handled as any of the heavy churn drills, and its cost of maintenance is believed to be no greater, but the extraordinary feature is the power cost. This sometimes runs as low as \$0.30 per day, and is never higher than \$0.75. It is understood that the electric power, 3-phase, 60 cycle, 220 volt, is costing the contractor \$0.0125 (1¼ cents) per K. W. hour.

The power cost of the electric air tripod drills is between 30 and 40 cents per day, drill runner \$3.50 to \$3.75 per day, and helper \$2.50. The holes are 10 to 15 ft. deep, bottoming at 1¾ in., and the average drilling per shift is 35 to 45 ft. This would make the drilling cost of these machines, based on power and labor (power 35 cents per day) approximately 20 cents per foot of hole drilled).

Comparison is suggested between the performance of these electric air tripod drills and that of standard 3½ in. air operated drills. Assuming that the average free air consumption per drill per minute is 150 cu. ft. compressed to 90 or 100 lb. and taking the air from the highest type of Corliss Compound Condensing Engine Driven Compressor, with high pressure boiler, etc., would bring the power cost alone to 75 cents per day. Adding interest charges on the entire compressor installation, cost of appurtenances, pipe lines, etc., maintenance and depreciation would bring this cost of power per drill per day to \$1.25 or \$1.50, or

between three and four times the power cost shown for the electric air drill.

There are also working upon this contract some 3½ in. air driven drills of the type referred to above, which began work before the electric air drills were installed, and it has been found that with both working in the same rock the electric air drills actually average from 5 to 10 ft. per shift more than the air drills.

If instead of assuming the most economical type of compressor for the above comparison, the air had been taken from a straight line compressor of the old and still familiar pattern, working noncondensing with steam below 100 lb., etc., the discrepancy in costs would be much greater. In these installations experience has made it common practice to figure the power cost per drill at \$2.50 to \$3.00 per day.

Summing up in a sentence: it may be stated upon authority that the electric air drill wagon operating under the conditions and in the type of rock as found at Valhalla, is drilling these large blast holes to 30 ft. in depth at about 1-5 to 1-6 of the cost of any other drilling apparatus now known, and the electric-air drills are doing their work at ⅓ to ¼ the cost at which it could be done by any standard air-driven drill with the air supplied by the most economical air compressor.

Such a remarkable showing gives the Ken-sico reservoir contract a special interest to advanced engineers who are studying economical construction.

AIR BLAST IN FOUNDATION SINKING

The Underpinning and Foundation Company, 290 Broadway, New York, are employing a novel mode of constructing building foundations, the latest undertaking being for a 12 story apartment house at 85th Street and West End Avenue. When completed the foundation rests upon rock and may be called a reinforced concrete structure, it consisting of groups of 12 in. steel pipe filled with concrete and vertical steel reinforcing rods.

The ground is here hard and compact with the underlying rock at varying depths from 17 to 52 feet. The pipes used are in lengths of 12 or 14 feet, and in the deepest parts three or four of these are required, one above the other. The pipe after being properly located in a vertical position is driven a few feet by a Goubert pile driver sitting

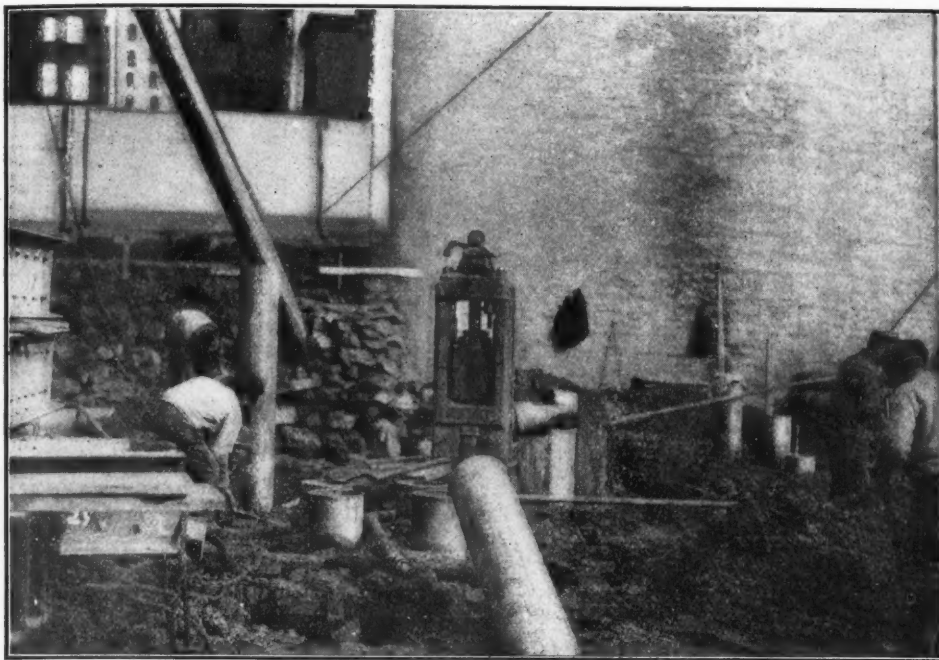


FIG. 1. GOUBERT HAMMER ON PIPE.

on the top of it. This hammer can be operated by either steam or air, and when in this case it was operated by air means of reheating the air were employed as close as possible to the hammer to prevent the freezing of the exhaust.

The pipe having thus been driven a certain distance, the Goubert hammer is lifted off by a derrick, the pipe is filled with water, an air pipe is thrust down as far as it will go and also a test rod which is used to ascertain when the solid rock is reached.

On the street close to the work is located a 20 in. Rand compressor and a large air receiver. The compressor is speeded up and when the receiver is filled to the highest working pressure all the air is suddenly turned into the foundation pipe blowing out the water, the dirt and the stones. This filling and blowing out is repeated several times until the air pipe has sunk to the bottom of the casing pipe. Then the hammer is put to work again, the pipe is driven another couple of feet or so, then it is filled and blown out again and so on until the rock is reached. The pipe is even finally

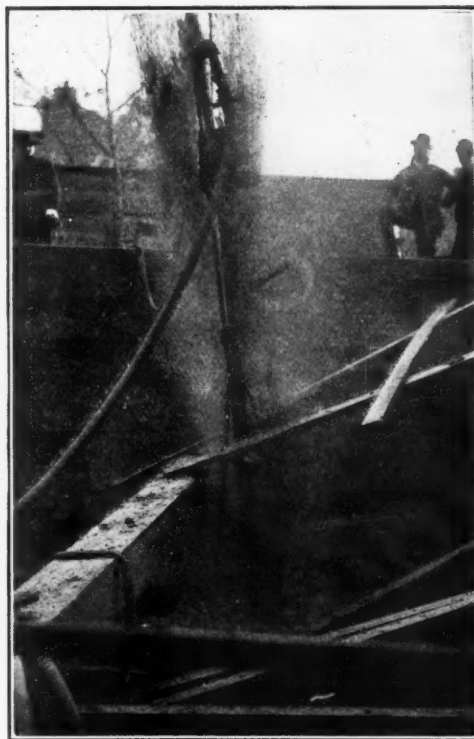


FIG. 2. BLOWING OUT.

(Continued on Page 6750.)

A COMPRESSED AIR TRANSMISSION CHART*

BY NATHANIEL HERZ.

The formula frequently used for computing the economical size of pipe to transmit compressed air is that of D'Arcy, as follows:

$$DC = \sqrt{\frac{d^5 (p_1 - p_2)}{w_1 l}}$$

Where,

D = The volume of compressed air delivered in cu.ft. per min., at the final pressure;

c = An experimental coefficient determined for the various sizes of pipe;

d = The diameter of the pipe in inches;

l = The length of the pipe in feet;

p_1 = The initial gage pressure in lb. per sq. in.;

p_2 = The final gage pressure in lb. per sq. in.;

w_1 = The density of the air, or the weight in lb. per cu.ft. at the initial pressure, p_1 .

The most common case is that in which the given quantities are: the quantity of air required, the length of the pipe, and the initial pressure. The method of solution is to assume a pressure loss and to compute the remaining factor, $c \sqrt{d^5}$, thus giving the size of pipe corresponding to the assumed loss of pressure. It is always desirable to try two or more pressure drops, in order to find the combination that is most satisfactory, since often a small change in the size of pipe will reduce or increase the loss of pressure several pounds. An alternative method is to assume a size of pipe and calculate the corresponding pressure drop. Each method involves a series of tedious calculations to arrive at the most economical solution, and also requires the use of tables giving the constant, c , the actual diameters corresponding to the nominal pipe sizes, the density of the air, w_1 , and often, for convenience, a table giving the value of the expression.

A graphic chart (see opposite page) has been

$$\sqrt{\frac{p_1 - p_2}{w_1}}$$

constructed for the solution of these problems with no computation, and without the use of tables. The procedure is as follows:

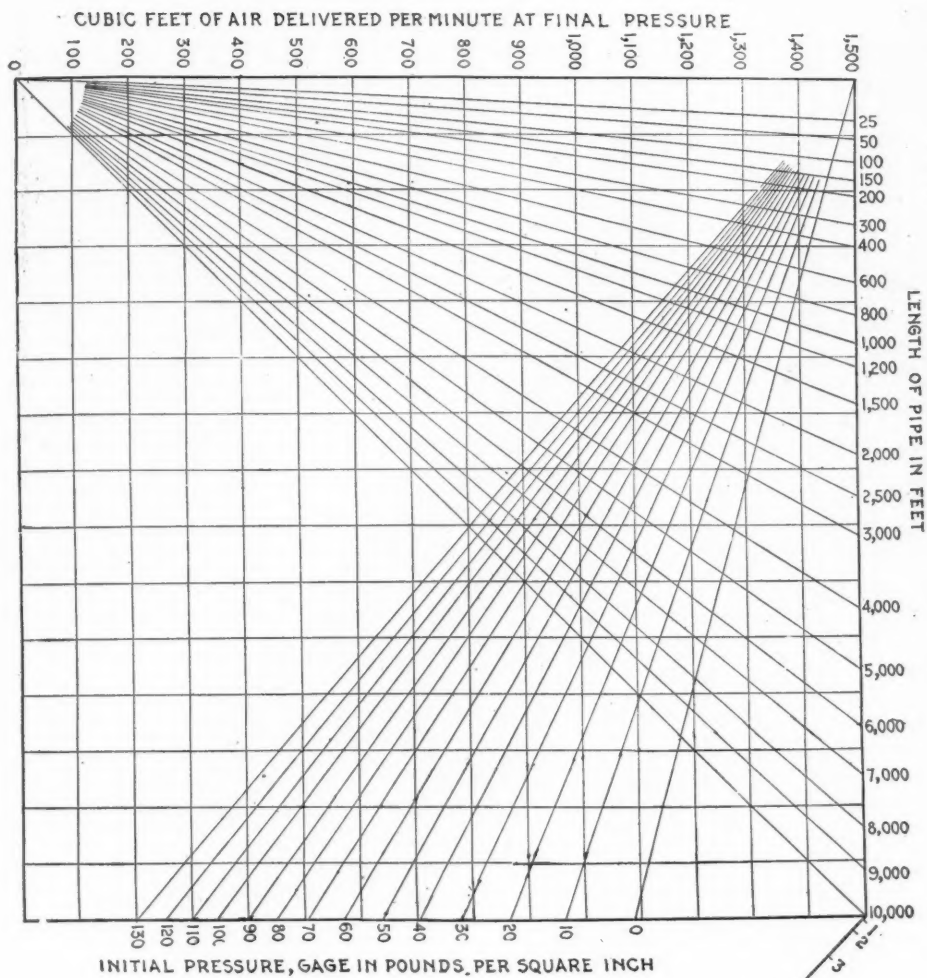
Begin with the quantity of compressed air delivered, on the left-hand vertical scale; follow across horizontally to the intersection with the inclined line corresponding to the length of the pipe line; pass up vertically to the inclined line corresponding to the initial pressure; then cross the chart horizontally to the heavy line at the right of the cross-sectioned part of the chart. The point here found is a pivot point, which is held with a pencil, pen, or needle point, and a straight-edge placed against it and swung across the "Z" diagram. Any two points on the inclined and vertical lines that are cut by the straight-edge at the same time go together as one solution of the problem, giving a pipe diameter with its corresponding loss of pressure. By swinging the straight-edge, it is possible to see at a glance how the final pressure is affected by a variation of 1 in. in the pipe size. Moreover, the size giving the most desirable result is determined at one operation. If the drop is considerable, it may be desirable to adjust the volume to correspond with the new final pressure, and to repeat the operation; but, within ordinary economical limits, the error involved by not doing so is negligible.

Sometimes the problem may arise in another form; for instance, to find the maximum volume that can be handled in an existing line. In this case, the process is reversed. Begin with the maximum desirable drop, and the size of pipe, then pass to the initial-pressure line in a horizontal direction, then vertically to the length line, and finally horizontal to the left-hand scale, which will give the corresponding volume. Any other combination can be solved in a similar manner.

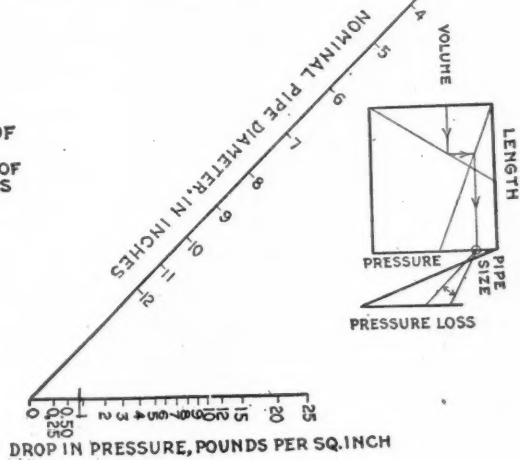
The accuracy of this chart is well within commercial limits. It has been checked against calculated values for combinations varying from 100 to 1000 cu.ft. of compressed air delivered per minute, pressure losses from three to 10 lb., and pipes from 10 to 4000 ft. long; all results were within 0.5 in. of the pipe diameter, and most of them within 0.25 in. or less.

Nearly 50 tons of water had to be raised out of the mines of South Staffordshire, Eng., last year to every ton of mineral.

*Excerpt from Bulletin A. I. M. E., Dec., 1912.



A GRAPHIC SOLUTION OF
D'ARCY'S FORMULA
FOR THE TRANSMISSION OF
COMPRESSED AIR IN PIPES



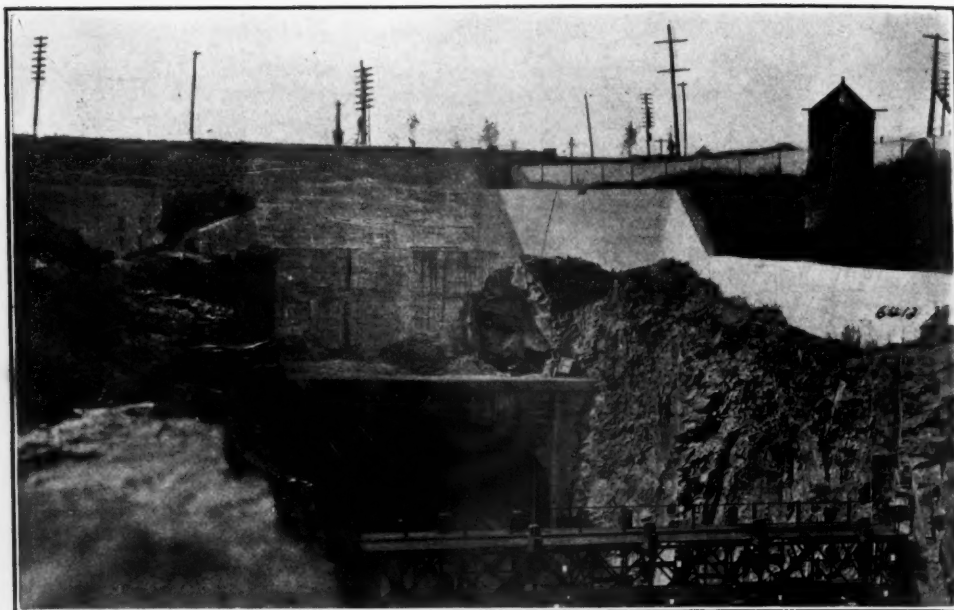


FIG. 1. ONE OF THE TUNNEL-BRIDGES.

REINFORCING TUNNEL LININGS

BY FRANK RICHARDS.

An unusual and difficult engineering task has recently been accomplished at the Bergen Hill, Jersey City cut, of the Erie Railroad. This is a deep open cut with four tracks now used for the passenger traffic of the road, instead of the long and smoky tunnel so unpleasantly remembered by old travelers.

This cut is crossed by four tunnel-bridges at important boulevard crossings. One of these is shown in Fig. 1 with the light from the other side showing upon the tracks below. These tunnels have thick concrete roofs or linings which have developed serious leaks and disintegrating tendencies that have begun to urgently demand remedial measures. It was apparent that no doctoring of the concrete from within the tunnel could be permanently effective, and it was determined to drill down to the concrete from the street surface above and to pour in sufficient grouting to solidify the entire mass. As there is more or less timbering above the concrete there are cavities sufficient to provide free flow for the grouting.

The most difficult part of the undertaking was the drilling of the holes, and at this writ-

ing this has been successfully accomplished. The depths to be drilled varied from less than 40 to more than 50 feet, which would not have been a serious matter if it were all in solid rock. Upon the average about one-half of the drilling was through a heterogeneous mass of material comprising earth, stones, more or less iron and other rubbish compacted together, with occasionally loose or unfilled spaces, so that the drill runner was in constant anxiety and alertness to prevent the drill piston striking the front head.

This evidently was not a case where a tripod drill could be used to advantage, and the drill actually employed was a G-105, Ingersoll-Rand drill with steam cylinder $4\frac{1}{4}$ in. diameter and 8 in. stroke. This drill was mounted upon a drill wagon (Fig. 2) which provides a secure guide for the drill and carries also a 15 H. P. boiler to supply the steam. The guide for the drill provides a feed of $4\frac{1}{2}$ feet and its base is a quadrant pivoted at the rear and permitting a horizontal movement of 30 degrees or more by which the drill may be moved laterally to either side when steels are to be changed, and immediately returned to correct alignment for drilling. A small auxiliary engine operates the feed screw for hoisting the drill or for running it up or

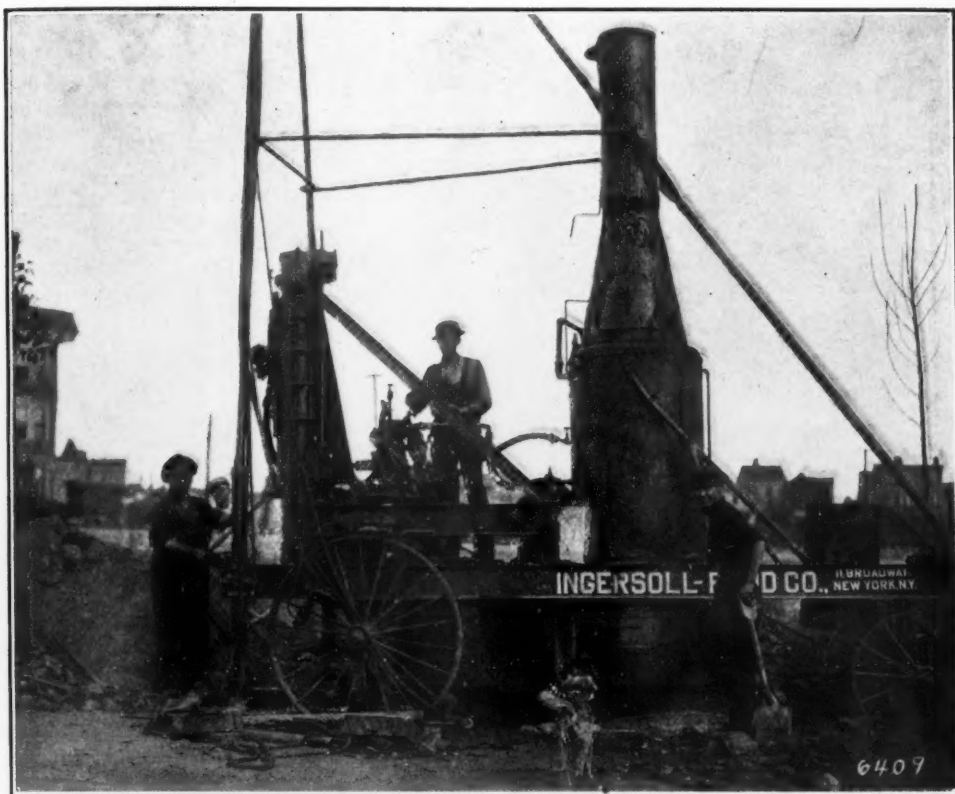


FIG. 2. DRILL WAGON AND GANG.

down as required, the feed when actually drilling being generally by hand. The derrick provides a central hoist of 20 ft. for the steels.

Each hole was started with a $4\frac{7}{8}$ in. bit, and as each limit of feed was reached a 4 ft. length of 4 in. casing was inserted. The casing was driven down by the steam piston striking upon a block. The chief purpose of the casing, which was continued only until solid rock was reached, was to prevent the dropping of loose material to choke the drill and also to keep the hole straight. Even this precaution was not always effective. The writer watched the drilling of the last foot of solid rock reached by a 20 ft. length of steel, and when it came to lifting out the steel this actually took a longer time than the drilling, the drill being caught by some obstruction after pulling up a short distance.

It took about three days to drill the first hole, great care being required to avoid striking the cement casing which was 5 ft. thick.

In the later holes it became easier to determine when the lining was nearly reached. On the second hole they had a harder time, several steels being broken before the depth was reached. With the 50 ft. steel in use the boiler was taxed to its limit for steam. The steel shown in Fig. 3 only just reached the bottom of the deepest holes.

No complete statement can be given of the quantity of cement used. When the work was visited 1,600 bags mixed very thin had been poured into the first hole, and the indications were that 1,000 more bags would be required. From the condition of the casing to be reinforced, the pouring in of the grout from above entailed a great amount of alertness and ingenuity in the tunnel to stop the leaks and hold the material from escaping. For this work platforms were provided upon flat cars and a lot of men had to work like beavers with oakum and other materials for stopping the flow, and even then everything was covered



FIG. 3. ONE OF THE STEELS.

with leakage, making an interesting study in monochrome.

The work is being carried on by the Smith & McCormick Company.

COMPRESSED AIR AIDS QUARRY ELECTRIFICATION

BY CHAS. A. HIRSCHBERG.

That electricity in the quarry has merit not possessed by any other power transmitter cannot be gainsaid. Especially does this hold true in the colder climates, in such quarries where winter operations are not only desirable but necessary to meet the increasingly large demand for dimension stone and crushed rock products.

To give the unfamiliar reader a better understanding of the conditions obtaining in quarries operating in winter, a brief outline is here given of the various kinds of quarrying machinery in use, the class of work to which each is adapted, and the advantages and disadvantages peculiar to each.

Broadly speaking, there are two main classes of quarrying machinery, namely: the track channeler and the rock drill for quarry bar, tripod, gadder and hand use.

The track channeler may be of several types; fixed back or adjustable back or arranged for undercutting.

The first is adapted for service in those quarries where the rock beds are horizontal or nearly so; the second, for angular cuttings in quarries where the floor is to be enlarged or where the formation dips or inclines and it is desirable to follow it without removing the overlying rock. This latter type is more frequently employed in quarrying marble. The track channeler is used in making the long deep longitudinal cuts (averaging from 8 to 16 feet in depth, depending upon the nature of the stone) which are preliminary to further breaking by the plug and feather method. The undercutting channeler is intended to meet conditions in quarries of marble, slate, sandstone and other rocks, in which there are no free horizontal beds and where the cleavage of the stone is vertical, or nearly so. In such places, it is necessary to undercut the bench as well as to channel the sides.

The different makes of track channelers on the market, while alike in general principle, differing only in minor details of construction and design as affecting the economy of power consumption, channeling speed and ease of handling may again be divided into three classes; those operated by steam, those in which compressed air is the transmitting power and the electric-air type; which is distinguished by its combined use of electricity and compressed air as a motive power, and

which in this respect is a distinctive departure from all previous practice.

In the second group, that of the rock drill variously mounted, we also have the sub-classification of power; steam, air and electric-air.

This class of machine is used in combination with some type of either special or standard mounting, as for instance the quarry-bar, which is used for channelling purposes and the drilling bits are of regular channelling formation; for broaching, plug and feather work, lofting, etc.

Here, however, we have this distinction, that while the track channeler is operated on a portable track, this outfit consists of a modified drill mounting, with four legs and provided with either two parallel bars in horizontal position as also a horizontal screw feed for moving the drilling engine carriage longitudinally, or a single horizontal bar with a rack feed.

This outfit is moved about from place to place by hand.

These drills are also used in conjunction with the long familiar tripod mounting, and a portable mounting known as a gadder frame for putting in a row of holes in a side wall at any angle from horizontal to vertical. These holes may be either broached or the break may be made by the plug and feather method.

STEAM CHANNELER EQUIPMENT.

Here, it is at once apparent that the chief advantages lie in the securing of greater independence of accessory power plant equipment, this being especially true where the work is of a temporary nature. So far as general efficiency is concerned this type of machine ranks very highly, but the economy of power obtaining with either air or electric current is not to be expected in cold weather owing to radiation and condensation of steam in transmission.

Its disadvantages briefly summed up are, the interference experienced by the operator from exhausting steam, the time consumed attending fires, the discoloration of the stone from coal and ashes and, as above stated, the difficulty experienced from condensed moisture.

COMPRESSED AIR CHANNELER EQUIPMENT.

Here also, we have a very efficient equipment, only applicable, however, under condi-

tions which are ideal. While employing the well known successful application of compressed air, its advantages are more than offset by the many disadvantages to contend with in cold weather operations.

First it is dependent on a central plant, necessitating the laying of pipe lines in the quarry as work progresses, involving considerable labor in addition to the trouble experienced from freezing and bursting pipes, and the necessity for using a reheater attached to the channelling machine. Steam equipment would be far preferable to this.

ELECTRIC-AIR CHANNELER EQUIPMENT.

Here we have a utilization of power with design which makes it an all-around ideal quarry equipment for convenience, economy and adaptability; one that is entirely independent of weather conditions; one that does not necessitate the installation of costly power house equipment by the operator unless he so desires, as current may be cheaply purchased from outside sources. Electric wiring is sub-

This device represents more than an air channeler with a portable electric driven air compressor. It is a complete system in which compressed air produced by a tandem single-acting pulsator driven by a standard electric motor is applied to the piston of the cutting engine, all being mounted on the same frame. The air is never exhausted but plays back and forth under pressure in a closed circuit. There is no rigid connection between the motor pulsator and the cutting engine, this being accomplished by flexible joints.

The same conditions prevailing with channelers are to be met with in the use of all rock quarrying machinery, so that the same stituted for pipe lines, etc. arguments apply with the second classification.

While Steam and Air equipment have held the bulk of favor during the past years, the tendency toward electrical operation is becoming more and more marked, as its advantages are becoming better known. The ideal will have been attained when the quarry becomes universally electric.

A wooden ship called the Seal, built in 1810 at Southampton, is still in use, and will shortly sail from Biddeford, England, to Durban, South Africa, a distance of 6,000 miles.

THE LEYNER DRILL SHARPENER

The interesting machine here shown would seem to be entitled to a name more suggestive of the scope of its work. It is not only a drill sharpener but it is first of all a drill maker, and it does various other things as the occasion arises. It is an ingenious machine, a highly efficient machine and it challenges interest and appreciation. If we realize the responsibility of the rock drill and the strenuousness of its task in quarrying, mining, tunneling, in all engineering work requiring the rapid piercing of the solid rock, and then how all the success and accomplishment of it de-

blacksmiths have done the best they could, and the drillers have learned to worry along with such bits as they could get, well knowing that they could not dictate much as to the shape or condition of the steels used. The coming of the drill sharpener has reacted upon the driller. He has found that he can get more reliable bits, both as to shape and size, and also temper or stand-up qualities, that he can have them cheaply and quickly renewed, and he never has to strive to get all the work possible out of each steel before changing. The increased day's work tells the story.

The machine is entirely pneumatic in all its

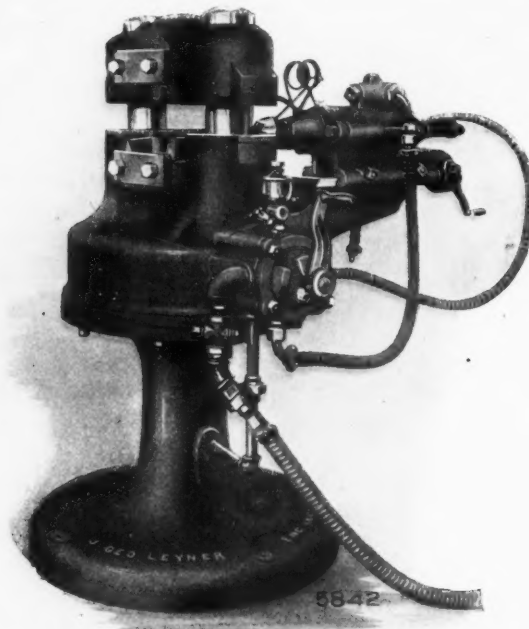


FIG. 1. LEYNER DRILL SHARPENER.

pends upon the proper shaping and maintenance of the drill steels or bits, we may somewhat appreciate the intensified and concentrated responsibility of the agency by which the fitness and efficiency of the drills are to be maintained.

The making and redressing of drill steels is in these days too much of a job for the primitive, unassisted blacksmith and helper, and where more than two or three rock drills are working together hand work is not to be thought of for the drill maintenance. The

functions and is operated by the same air pressure, 70 to 100 lb., which is most satisfactory for the drills. There are three distinct movements or operations. The steel is clamped or held in a horizontal position so securely that no backer is required for the steel in the act of upsetting, and no space is required outside the machine except for the length of the steel itself. In the making or sharpening operation the body of the steel is subjected to no shock or strain, and the normal condition of the metal is not disturbed.

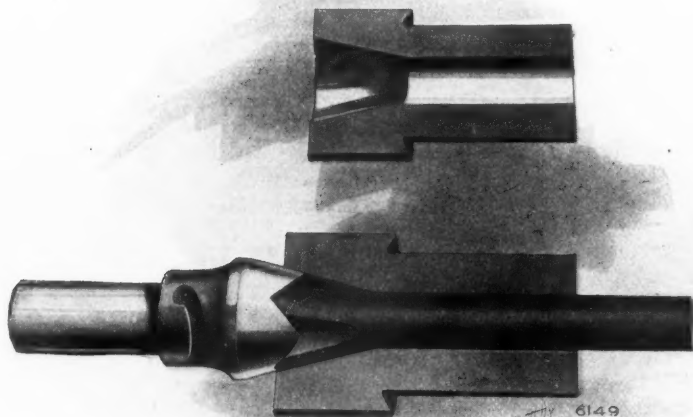


FIG. 2. DIE, DOLLY AND BIT.

The steel with its end heated is brought from the fire and clamped in the vise, which is done by the descent of the heavy crosshead above, this being actuated through the heavy side bolts by the piston in the big, short cylinder below. Dies are inserted in the upper and lower faces of the vise which together form a conical cup or enlargement which limits and shapes the outside of the bit when it is being upset. The dies are quickly removed, replaced or changed as required.

The heated end of the steel projects a little beyond the die as located by a gage and then the dolly is advanced and pressed with great force against the steel, this being the

second movement spoken of, and at once the third movement occurs, this being a sharp and rapid pneumatic hammer action behind the dolly, the combined pressure and hammering very quickly upsetting the steel until it fills the die. For this operation a single heat is sufficient unless the required enlargement is excessive, when two or more heats may be required. The usual end of the operation is when the outside of the dolly fills and fits the conical cavity in the die. As different dollies are required for bits of different sizes, these are not fastened in but held by a light spring so that they can be instantly changed as required.

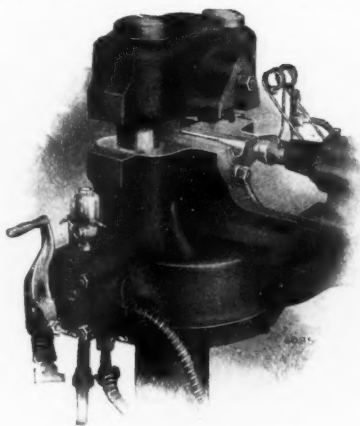


FIG. 3. VISE OPEN TO RECEIVE STEEL.

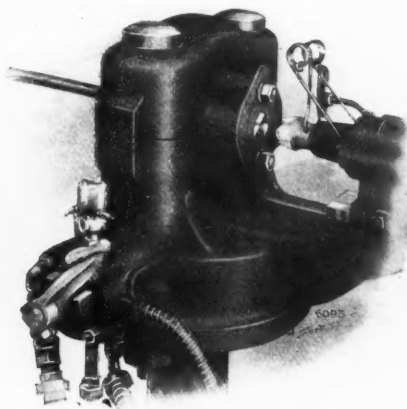


FIG. 4. STEEL CLAMPED FOR DOLLYING.

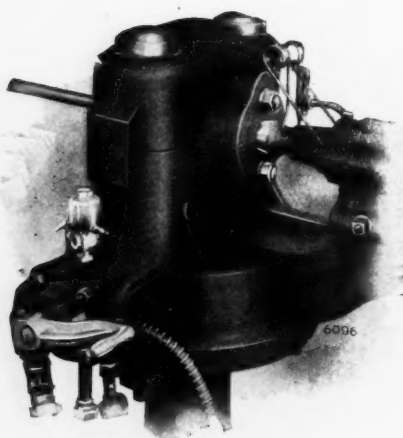


FIG. 5. DOLLYING THE STEEL.

The illustrations should give a tolerably clear idea of the normal operation of the machine. It will be noticed that in Fig. 2 the positions of die, dolly and steel are reversed. The operating of the drill sharpener is a very simple matter, the large crank lever in the front of Fig. 1 controlling all the movements. This lever in the vertical position as shown, raises the crosshead with the top half of the die; moving the lever forward 45 degrees low-

ers the crosshead and clamps the steel, and moving it another 45 degrees operates the dolly. By reversing the movements of the lever the dolly is stopped and the crosshead is raised to its original position.

While the four-point cross bit is more easily made, the single or double chisel, three, four, five or any other number of point bits, as well as the "Z," "X" and other special forms are readily made. The machine is also adopted, by the addition of suitable dies or devices, to many other classes of work. Pipe hangers, pins and spikes, drill steel shanks for either hammer or piston drills, are readily made as well as bolt and rivet heads. Various kinds of bending, forming and forging can be done. Fig. 6 is a view of the back of the vise showing how various swages may be used and how easily they may be inserted or changed by merely slacking the bolts which hold the plates.

HIGH PRESSURE GAS COMING

The Bradford, England, Corporation gas committee has decided to install a system of high-pressure gas lighting for the central portion of the city. It is stated that recently many improvements have been made in the

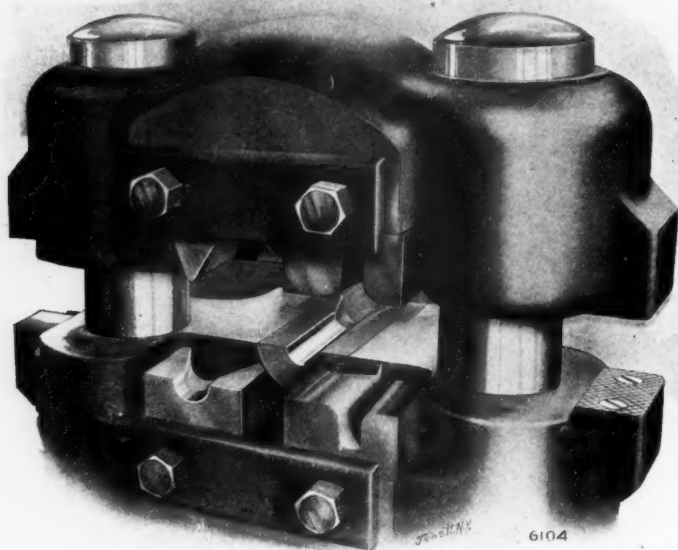
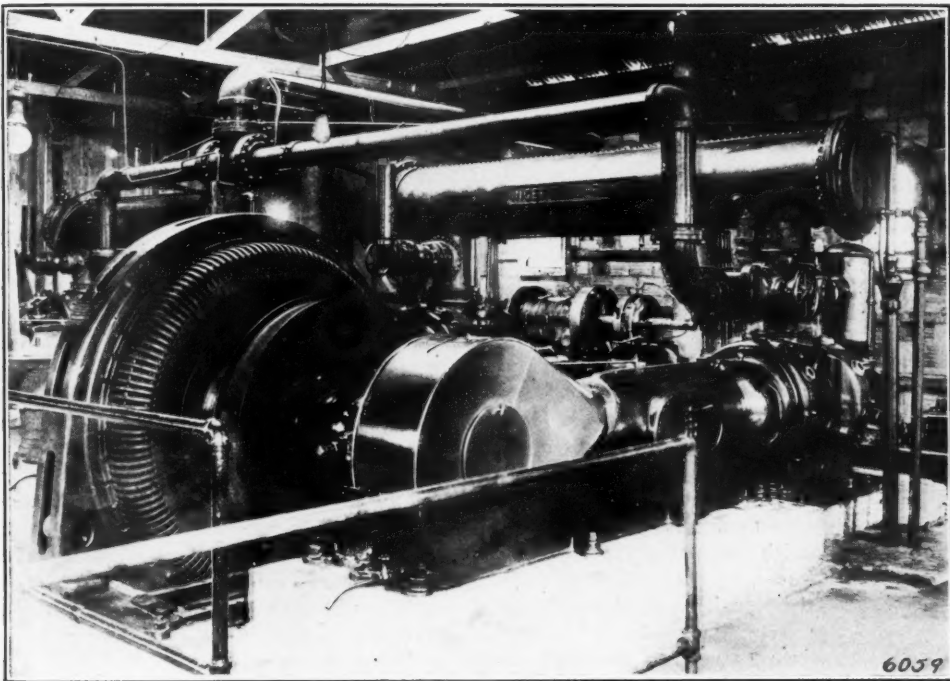


FIG. 6. BACK OF VICE.

apparatus for gas lighting at pressures of from 2 pounds to 3 pounds per square inch and that the system is now in successful operation in several towns. A compressing plant will therefore be installed in Bradford and steel gas mains laid down, at a total cost of \$141,128. With the lamps available it was estimated that three times the amount of light could be obtained from a given consumption of gas under high pressure than from the ordinary incandescent burner, while the extra cost of mantles and maintenance would not be excessive. Some 30 or more firms in Bradford already have their own apparatus for compressing gas for their own use.

tunnels and the subway work, and latest of all the great water tunnel, have not only provided the ways and means for what is best in compressed air practice, but the magnitude of the undertakings has made it worth while, and even imperative, to adopt the most economical and reliable apparatus procurable regardless of the cost of installation.

Accordingly the several air compressing plants employed by the great contracting companies for the works but recently completed were regarded as models of up-to-date-ness in every detail which could promise economy and precision of working, and both the contractors who owned and operated them and the design-



ELECTRIC DRIVEN COMPRESSOR ON SUBWAY CONTRACT.

THE AIR COMPRESSOR AND THE ELECTRIC DRIVE

BY FRANK RICHARDS.

Changes in compressed air practice, or, more precisely, in air compressing practice, have been succeeding each other with astonishing rapidity since the present century began, and nowhere more noticeably than in New York City and its immediate vicinity. Here compressed air has found one of its great opportunities. The North River and the East River

ers and builders who were their sponsors, all were proud of them, and the technical press wrote appreciative descriptions of them as a labor of love.

These were steam driven plants, with all the accepted steam and power economizing devices, which need not here be enumerated in detail, and the air ends also provided for two-stage compression with efficient intercooling and automatic regulation which allowed no power to run to waste when the load was light.

Although the work for which these compressors were employed was necessarily of a temporary character there was no temporizing or makeshift about them, and day by day, comparing their performance with that of "simple" machines which might have done the work, they piled up the savings and paid for themselves over and over.

They made such an excellent showing that, humanly speaking, we might have said that these machines, although their first job was done, would be sure of employment again as soon as there was more work in their line to be done. They were still practically good as new, so there could be no plea of old age suggested against them.

The first batch of New York river tunnels, the first subways, the Pennsylvania terminal, have all been completed. Now we have the great water tunnel being driven the entire length of Manhattan and through Brooklyn to Staten Island, and subways without end are under way, but so far as the present writer is informed not one of these compressors of such excellent record has come into play.

While these fine steam compressors were at work other things also were working. Especially was electricity having a phenomenal business development. Splendidly equipped electric light and power plants of almost unlimited capacity were being installed in New York as well as in every large city, and these taking advantage of every possible economy in steam generating and in power development have been enabled to offer currents for drive have been enabled to offer current for drive poses at rates which have practically compelled acceptance.

The electric drive under such circumstances is an attractive proposition. The first cost of the electric driven compressor is much less than that of the steam driven plant with boiler, piping and other appurtenances and fuel handling and storing arrangements. The operating force required is reduced to one-fourth or less and the ground occupied is also minimized with no exacting requirements as to location so that generally the compressor may be located much nearer the work with a great saving in air pipe lines. The power required is always ready without preliminary notice and the power cost stops entirely when the compressor stops.

The advantage of the electric drive thus offered has been so evident from a strictly busi-

ness and money making viewpoint that it could not be ignored and new electric driven plants have been installed for the extensive new lines of work because it was simply the cheapest thing to do.

The installation which we get a glimpse of in the halftone herewith is that of the Bradley Contracting Company, New York, which has a contract for a large portion of the Lexington avenue subway. It is located at 96th Street and First Avenue, close to the East River, and it is typical of the plants employed upon this and similar work, there being a score of compressors of the type here shown now in operation in Greater New York.

The plant comprises five Ingersoll-Rand, Class P E-2, electrically driven cross compound compressors with cylinders $25\frac{1}{4}$ in. and $15\frac{1}{4}$ in. diameter and 21 in. stroke, delivering air at 100 lb. gage, with an individual free air capacity, at 187 R. P. M., of 2110 cu. ft. per minute, or an aggregate of 10,550 cu. ft.

These machines have G. E. direct connected self-starting synchro-motors with belted exciters, 365 brake horsepower, 6600 volts, 3 phase, 25 cycle, the rotor mounted on the crank shaft with a bearing in each frame, this arrangement giving a greater efficiency than that of a high-speed belted motor. Current is supplied by the New York Edison Company. The rotor of the motor is heavy enough to give a sufficient flywheel effect, in this assisted also by the pulley which drives the exciter.

A speed of 187 R. P. M.—654 feet piston speed—is high for a compressor of this size, but it is easily practicable with this type of machine by reason of the massive design, the perfectly maintained alignment, the equitable distribution of the load and the flood system of lubrication.

It is not necessary to mention in detail the special features of design and construction in these machines. The frame on each side is of the heavy duty engine type, supported for its entire length upon a massive and carefully prepared foundation, while the cylinders resting on sole-plates are made underneath with full box construction, the box forming a settling chamber for the water jacket.

The cranks, crossheads and connecting rods can all be got at while the machine is running, through the doors on the oil guards and through a larger doorway on the side. A constant flow of oil is delivered to the main bearings, the crank pins and crosshead pins,

and also to crosshead slides and piston rods. The flow of oil begins as the machine starts and its delivery is proportional to the speed, all the oil returning continuously to the oil reservoir. For lubricating the air cylinders, where the desirable quantity is a minimum, sight feed lubricators are provided.

A special conduit running lengthwise under the building is provided for the free air supply. The air inlet valves are of the "Hurricane" piston inlet type and the discharge valves "Cushioned Direct Lift," both having the highest practical endorsement of long and extensive successful service.

A large intercooler is set transversely above the cylinders of each machine, forming the air connection between them. In this case special cooling tubes of "admiralty bronze" are provided, so that the more or less saline water of the East River may be used for the circulation. The tubes are in pairs, an inner and an outer; the cooling water enters the lower row of tubes and passes back and forth between the inner and the outer tubes, discharging from the top row. Leaving the intercooler the water passes around and under the high pressure cylinder and thence to the jacket of the hood, from below, discharging through the side of the cylinder. The air pressure at the intercooler is 27 pounds, gage. After leaving the intercooler and before entering the high pressure cylinder the air passes through a separator which takes care of all the water liberated by the intercooling.

The compressor runs at constant speed, and the means provided for controlling the air output according to the demand is an interesting and important feature. Each end of each cylinder is provided with an auxiliary clearance chamber, and when communication is automatically opened between any clearance chamber and its cylinder the air compressed for that stroke is not discharged into the receiver and pipe system but merely enters the clearance chamber, and upon the return stroke of the piston the force which has been expended in its compression is, upon its reexpansion given back to the piston and little of the power is lost. According to the number of these clearance chambers which may be thrown into action at once, the compressor may be working at full load, three-quarter load, half load, quarter load or no load, and the power consumed will be according to the actual air delivery. In two-

stage machines, such as those of the Bradley Contracting Company are, clearance space in corresponding proportion is used simultaneously on both the low and the high pressure cylinders, thus maintaining the ratio of compression constant and effecting an equal apportionment of the load.

From the preceding it will easily appear that a modern air compressor of the highest type is by no means so simple a machine as some might easily imagine, but all the refinements have full business warrant for their being.

From the compressor house the air is carried by a 10 in. pipe westward to Lexington Avenue, about half a mile, and then it is led away both north and south through long and increasing distances through 6 in. pipes and smaller. From the nature of the work it is impossible to make any intelligible comparison between the power used at the compressor and the power actually realized where the work is going on, as that is so widely distributed, so intermittent and of such varied character. The only thing until the work is finished is to have enough air always ready.

The 10 in. pipe from the compressor house is laid in the gutter in 96th street close to the curb, being carried overhead to cross three avenues. In the middle of each block a sliding expansion joint is placed and the long vertical pipes and curves at crossings also yield more or less. As the air starts on its journey its temperature is not less than 200 degrees, but before Lexington Avenue is reached not the slightest trace of heat remains, which shows how quickly the air cools off and the futility of ever attempting air reheating except close to the work.

Mr. Rea, the new president of the Pennsylvania R. R., was in charge of the building of the new terminal of the Pennsylvania R. R. in New York City. In the course of the work he often donned the oil skins and visited the tunnel being constructed under the East River. Tim McCarthy, foreman of the tunnel gang, became his warm admirer. A few days ago McCarthy heard of Rea's promotion. "Sure, I hope he'll be happy," said he, heartily. "But whin Sammie Rea wint into the railroadin' business there was the makin' of a mighty fine sand hog sp'iled."

AIR BLAST IN FOUNDATION SINKING*(Continued from Page 6736.)*

driven about two feet into the rock, the familiar New York mica-schist.

When the driving for the individual pipe is finished several steel rods are inserted and then both the outside and the rods are cut off to the required level by the oxy-acetylene torch, the pipe is filled with concrete and finally capped.

In this particular foundation the engineers have estimated 4,200 lb. per sq. in. as a safe load for the reinforcing rods and the pipe and 350 lb. per sq. in. for the concrete, the piles being distributed according to the requirements of the building and the varying characteristics of the ground.

This method is also being successfully employed for putting in new foundations under old buildings, a section of the building being cut out to give room for a short length of pipe and a hydraulic jack, the pipe being alternately jacked down and blown out and followed by additional lengths of pipe until the required depth is reached.

THE BUTTERFLY PICKAXE

BY S. W. SYMONS.

The versatility of the well known "Butterfly" hammer drill is being thoroughly demonstrated at the New York Terminal of the Brooklyn Bridge, where eleven of them are being used by the North Eastern Construction Co., to cut through cement, concrete, brick, and even steel ties, to make room for the Brooklyn Bridge Terminal of one of the new subways with which New York is being honey-combed and which, like most subways, is crowding its way through without regard for what ancient institutions like the Brooklyn Bridge it may overthrow in its progress. In this case no actual damage will be done, though it is probable that the bridge will be closed for a short period, and when reopened will present a different appearance at the New York terminus.

The "Butterfly" Drills are used to cut through the road-way from the entrance and 3rd Ave. street car tracks to the anchorage, the work at present being in progress only where there is no traffic.

The drills have to be relied upon to do everything, as blasting in this confined and congested place is prohibited. They are in



FIG. 1.

fact called upon to perform the same class of work as in the old days would have been done with the common pick-axe, and in this case they might well be termed "Compressed Air Pickaxes." The roadway to be removed is of very substantial construction: first there is a layer about 18 inches thick of fine cement concrete, then about three feet of rough concrete full of large gravel, then brick, supporting arches or vaulting.

METHOD OF WORKING

A large hole was first cut with the aid of the drills through the top of one of the arches, and a wooden chute was constructed to the space below; the roadway was then cut away above and below the hole and the muck shoveled down into a wagon placed below the chute. The material was cut away in layers or benches; first the top layer of fine concrete which, though hard, was fairly uniform and good cutting; then the rough concrete, which

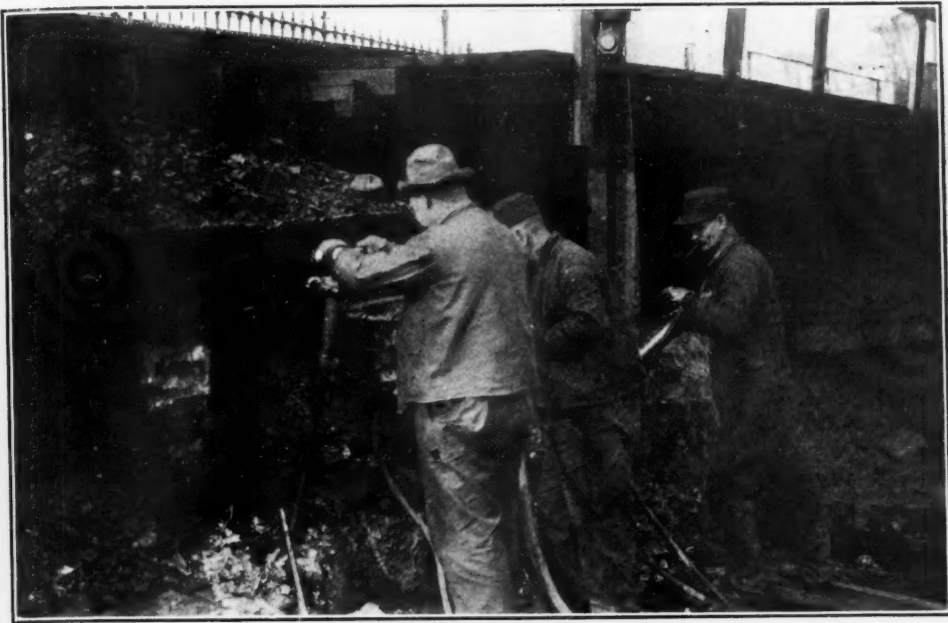


FIG. 2.

was very hard on the drill bits and taxed the capacity of the drill to the utmost, and lastly the brick, which was comparatively easy cutting. In one instance it was found necessary to cut through a steel tie to allow room for a heavy girder. This was done with the same drill steel as used for the concrete and was accomplished in the surprisingly short time of



FIG. 3.

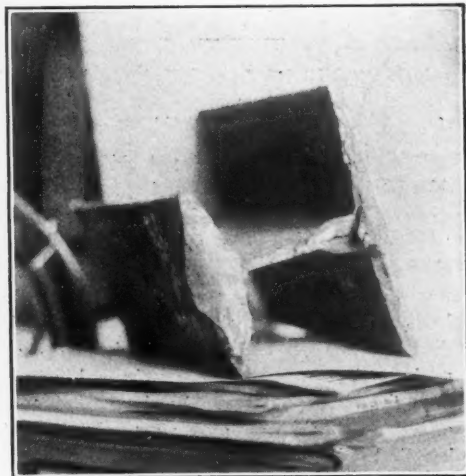


FIG. 4. I BEAM CUT OFF BY BUTTERFLY DRILL.

12 minutes. In another case the anchor bolts of the elevated structure had to be cut; the "Butterfly" Drill was so light and easy to handle, and the vibration was so slight that this was almost as easily accomplished as with a chipping hammer specially designed for that class of work.

The air was supplied by an Ingersoll-Rand Class "A" air compressor pumping to 110 lbs. at the receiver and giving 90 lbs at the drills.

The air after leaving the main pipe line was brought through a coil of pipe, made up of elbows and short lengths of straight pipe suspended over a fire bucket, this constituting a simple though hardly economical reheater from the bottom of which the hose connections were made; this reheating was done more for the sake of adding a little to the available air volume than for preventing freezing at the exhaust of the drill, as the "Butterfly" valve used on this drill is non-freezing.

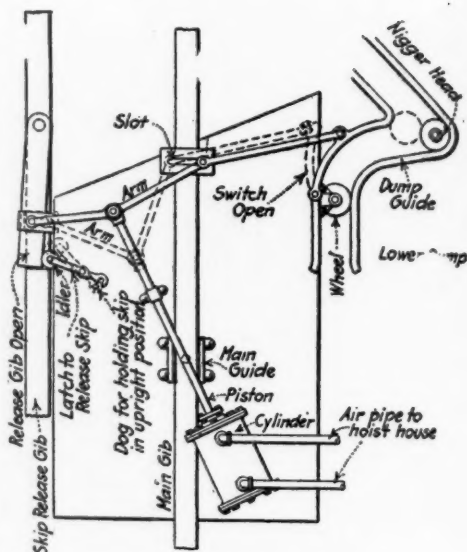
The steel used was solid hexagon. The first bit tried out was a regular chisel or "bull" bit rather spread at the edges. This was found unsatisfactory and was changed to a narrow pointed chisel about $\frac{3}{4}$ inch across the cutting edges dressed with the flat side on the corner of the hex, so as to present the strongest section of steel when used as a lever.

It is impossible to state at this time just how fast the work is done with the "Butterfly" Drill, as it constantly varies in character and there are no records of similar work with which to compare it.

COMPRESSED AIR DUMP CONTROL

BY J. R. MC FARLAND.

The Giroux Consolidated Mines Co. at Kimberly, Nev., has recently changed from cage to skip hoist. As it was desired to get the greatest possible production from the shafts considerable care was used in designing the dumping arrangement. The peak load of the day in the hoist room is after dinner. Almost the entire work of hoisting rock is done in the two or three hours before the shift goes off. As the rock is composed of both ore and waste it must be handled with discretion.



In order to avoid wasting time by having the skip dump into one chute and having a man climb up into the headframe and adjust a gate so as to direct the material into the ore bin or waste bin as the case requires, a new arrangement was made. Two bins are built. The lower one is for waste and the upper one is for ore. The man at the bottom of the shaft gives a signal by pulling a rope which rings a bell in the hoisting room. The signal designates a skip of ore or one of waste as the case may be, ready to be hoisted from the bottom. If it is a car of waste the engineer, by the operation of a lever at his side, controlling air to the dump machinery, closes a switch in the lower dump guide and releases a latch on the skip allowing the skip to swing at its center on the main guide. Thus the waste is dumped into the lower bin. If it happens to be a car of ore, by the operation of the same lever, he opens the switch in the lower dump guide, allowing the guide wheel to pass through, and at the same time the release gib is held closed so as to maintain the upright position of the skip. The skip thus passes through the lower dump and dumps the ore into the upper bin.—*Eng and Min. Journal*.

COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Established 1896

W. L. SAUNDERS, - - - Editor
FRANK RICHARDS, - - Managing Editor
CHAS. A. HIRSCHBERG, - Associate Editor
F. C. IGLEHART, JR., - Business Manager
W. C. LAROS, - - - Circulation Manager

PUBLISHED BY THE

Compressed Air Magazine Company
Easton, Pa.

New York Office—Bowling Green Building.
London Office—165 Queen Victoria Street.

Subscription, including postage, United States and Mexico, \$1.00 a year. Canada and abroad, \$1.50 a year. Single copies, 10 cents.

Those who fail to receive papers promptly will please notify us at once.

Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

Entered as second-class matter at the Easton, Pa., Post Office.

Vol. XVIII. MARCH, 1913. No. 3

CONTENTS

Rock Drilling at Kensico Dam.....	6731
Air Blast in Foundation Sinking.....	6736
Compressed Air Transmission Chart....	6738
Reinforcing Tunnel Linings.....	6740
Air Aids Quarry Electrification.....	6742
Leyner Drill Sharpener.....	6744
High Pressure Gas Coming.....	6746
Air Compressor and the Electric Drive..	6747
Butterfly Pickaxe	6750
Compressed Air Dump Control.....	6752
Air and the Rock Drill.....	6753
Confidential Employment Department...	6754
Dangers of Compressed Hydrogen.....	6754
Photography in Pneumatic Tool Manu- factory	6755
Air for Cooling in Drilling Steel.....	6758
Foam for Fire Extinguisher.....	6759
Electric Application of Air Brake.....	6759
Notes	6759
Patents	6760

AIR AND THE ROCK DRILL

From the beginning the rock drill has quite persistently insisted upon having compressed air to drive it. It does, indeed, do good work, but never quite its best work, when driven directly by steam; but the greater portion of its work, and that its most responsible work, has to be done where the use of steam is impossible, and thus while nothing but air will satisfy it nothing could serve it better.

The services of the air in connection with rock drill driving include two separate functions: first the transmission of the power, often for considerable distances, from the source of the power to the point where the work is to be done; and, second, the employment of the air in the actual doing of the work.

As a transmitter of power compressed air has a successful and pushing rival in the electric current; in fact where long distances are involved or where the work is distributed over large areas, the electric drive offers the engineer great inducements. It transmits the power so well and so cheaply, why may it not also actually do the work when it gets there?

To one not sufficiently familiar with the conditions under which rock drilling must generally be conducted it would seem to be a simple mechanical problem to produce some combination of electric motor and drilling tool which would be practical and efficient. Those who have had to meet the operative conditions of service in rock drilling, however, have not been so sanguine, and all their experience has been discouraging. The rough-and-ready service which an elastic medium, such as compressed air, can provide, meets the working conditions in a manner which has not been found practicable when the electric motor is mounted directly upon the jarring and pounding machine; while the general adaptability of the modern rock drill, the property which has really made its success largely possible, is the result of a flexibility and elasticity, combined with details of mechanical construction, which have been evolved in the hard school of experience.

The call for the electric drive for the rock drill has been so insistent that it would have been a wonder if something had not come of it. The seemingly impossible has been completely accomplished, and both electricity and

compressed air may be said to have won. The electric air drill is more completely an air operated drill than any of its predecessors, for not only is air its actuating fluid, but it is so exclusively, since it would be impossible to work the drill by steam, and it is also entirely electrically driven since all the connection it has with the power house are the wires right up to the mechanism.

With the advent of the electric air drill it becomes possible to use only the one power transmission for extensive engineering plants with a variety of apparatus to be operated. There is no question at all about the electric drive for hoists, conveyors, stone crushers, concrete mixers, pumps and the rest, and the electric air drill makes the big compressor and the costly pipe lines in many cases superfluous.

A CONFIDENTIAL EMPLOYMENT DEPARTMENT

It has been determined to open in the columns of COMPRESSED AIR MAGAZINE a confidential employment department which shall be of service to both employers seeking assistance in the conduct and execution of their work and to competent and experienced men capable and desirous of filling such positions. A large part of the work for which compressed air furnishes the power is of a more or less temporary character, as in tunneling, shaft sinking, general engineering and construction, and often also in mining and quarrying. There are new undertakings constantly beginning and others coming to a finish, and between these there are new arrangements to be made which often leave both employers and those seeking employment out of touch, and we would be glad to be instrumental in bringing these together for the benefit of all concerned. This department may be regarded as at present a more or less experimental one, but it is purposed to give it a fair trial. We assume no responsibility except to use our best judgment as to credentials of those whose names appear on our list. We make no charge for our services and we can only give the addresses of those listed to any who may require them. We cannot undertake to carry on correspondence. Those wishing addresses will please refer to them by their numbers.

1. Wants to take charge of underground

work. Was for several years head mining captain in a Michigan mine.

2. Has held position as superintendent of mines in Colorado.

3. First class operator of Leyner drill sharpener. Repairs drills.

4. Compressor engineer or to take charge of plant. West preferred. Now employed.

5. Channeler runner and general mechanic on quarry work.

6. Salesman or to take charge of machinery business. Experienced machinist.

7. Speaks and writes Spanish and familiar with Portuguese. Tunnel man familiar with drills and air machinery. Has successfully conducted railroad work in Brazil.

8. Graduate of Mich. College of Mines, 1909, and actively employed in mining service ever since. At present superintendent of prominent copper mining company. Will consider similar position.

9. Graduate of Michigan College of Mines. Has been superintendent of large mine several years, still holding the position. Thoroughly competent to handle large mining proposition.

DANGERS OF COMPRESSED HYDROGEN

The explosion of tubes of compressed hydrogen, accidentally contaminated with air, on connecting with a manometer to measure the pressure, has been investigated by Lalarge, who has found that if ordinary manometers are employed in the usual way, such explosions may occur whenever the hydrogen contains enough air to render it explosive, and the pressure is sufficiently high. The reason probably lies in the rise of temperature produced by the sudden and more or less adiabatic compression of the air in the manometer. Such accidents may be avoided by interposing, between the tube of compressed gas and the manometer, a safety-tube containing disks of metallic gauze of such mass that they are not appreciably heated by combustion of the gas mixture in the manometer. By this means the ignition of the main body of gas is prevented. Similar safety tubes should be employed whenever a highly compressed explosive gas mixture is allowed to expand suddenly into a confined space. Before measuring the pressure of compressed hydrogen, liable to contain air or oxygen, it is advisable to determine its density, as a further safeguard.

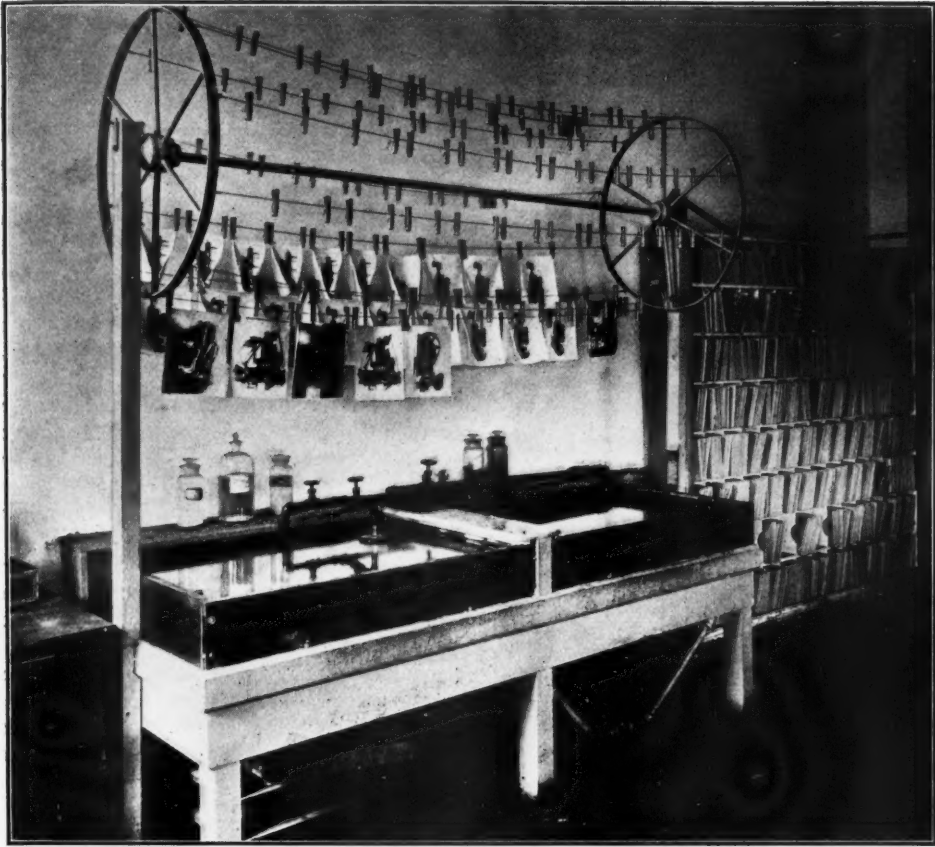


FIG. 3.

PHOTOGRAPHY IN PNEUMATIC TOOL AND AIR COMPRESSOR PLANT

There is presented in what follows a brief description of the photographic practices followed by the Ingersoll-Rand Company. This company maintains an extensive photographic department as an adjunct of its publicity bureau at Easton, Pa., and its experiences and methods may be offered in further explanation of the facilities provided for utilizing photography in large industrial organizations.

Like others which have a large and varied line of product, the Ingersoll-Rand Company finds the use of the camera by its own experts of almost indispensable value not only in connection with the preparation of its catalogues and descriptive literature, but in other directions as well. The output of the photographic department of the company may be divided into five classes as follows: 1.—Shop pictures.

2.—Reproductions of wash drawings, tracings, line drawings and retouched photographs. 3.—Bromide enlargements for framing. 4.—Out-



FIG. 2.

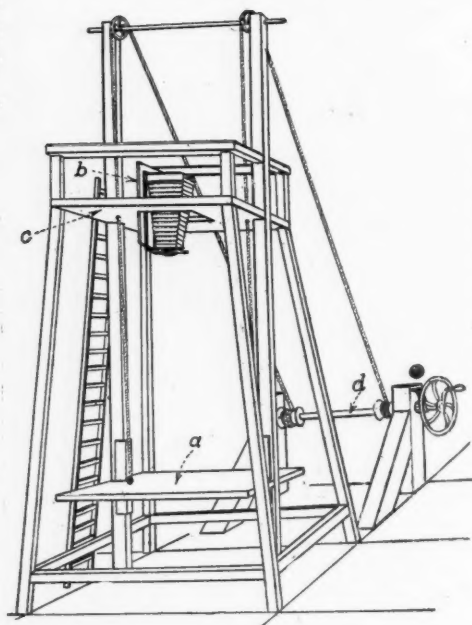


FIG. 1.

side views and installations. 5.—Lantern slides.

In the execution of their work and in devising apparatus to obtain the best results the photographers of the Ingersoll-Rand Company have exercised ingenuity as well as skill. Tak-

ing up in their order the various classifications alluded to, many interesting points may be touched on in even a sketch of the methods.

When it has been determined in the preparation of a catalogue what illustrations are to be used, the photographic department is authorized to take the necessary pictures, the detail and arrangement of the subjects being made to conform with instructions given with the order. Each particular line of machinery is photographed in the department producing it, and the shop-engineers assist in arranging the machine and parts to insure the showing of all essential details.

In all shop photography many difficulties are encountered, and these are often accentuated in the case of the Ingersoll-Rand Company because its products include large machines which are too heavy to permit of easy rehandling. Consequently some machines must be photographed on the erecting floor just as assembled under conditions which are anything but satisfactory because of poor light, close quarters, etc. Under such circumstances a good lens, equally good judgment and a correct use of flashlight powder are essential to good results. The company's photographers also make use of a muslin or canvas curtain fastened on a wire and supported at either end by wooden poles 10 or 12 ft. high for a back-

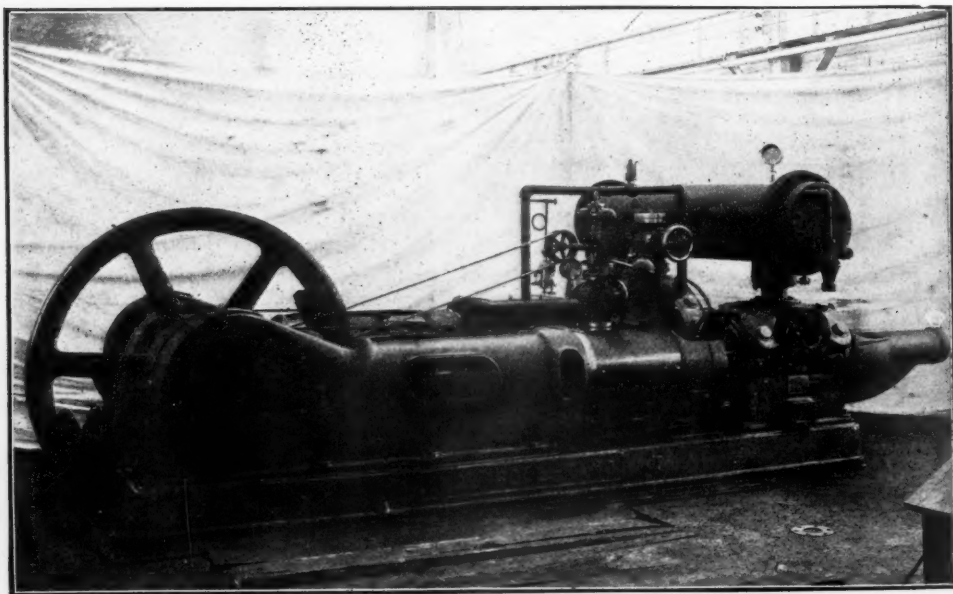


FIG. 4.

ground as shown, for example, in Fig. 4. Flashlight powder and flashlight bags are located in such positions as will light up the dark recesses and bring out details. Here, it may be said, good shop photography requires an assortment of high-grade lenses to prevent distortion and get correct perspective. In their work of making pictures at close range the Ingersoll-Rand photographers use lenses averaging from $7\frac{3}{16}$ to $23\frac{1}{8}$ in. in focal length.

Duplicate part photographs, used by some firms in the making of what are called "renewal sheets," involve another use of the camera in the making of shop pictures. In the production of these the Ingersoll-Rand Company uses an adjustable frame, Fig. 1, which has been found to work very successfully. The parts are arranged in proper rotation on platform *a*, and the camera is attached to support *b* on the platform *c*. To accommodate the changing quantities of parts on various pictures, platform *a* is made adjustable and can be raised or lowered by means of the windlass *d*, to suit conditions. It is advisable to locate a frame of this kind in the open so as to get the best light possible.

The value of the camera in the copy room of the publicity bureau is great as it is regarded as indispensable in reproducing. After the air brush artist completes a wash drawing it is sent to the copy room and photographed in a convenient size for distribution. Line drawings, tracings and retouched photographs are given the same treatment. The room in which this work is done must have a sufficient number of windows to afford good lighting, and the windows must be equipped with shades in order that the light may be controlled. Fig. 2 shows a camera stand used in the copy room and for so-called process work is declared to be a necessity. The tracings or drawings are mounted on frame A, which is constructed to permit its being moved in any direction by means of conveniently located handles, making it easy to bring the axis of the lens into correct relation with the position of the subject. The stand is strongly made of 2 in. material with steel springs for absorbing the building vibration, and heavy castors to allow of its being moved about with ease. The grooves in bed B are accurate in alignment so that the camera (which is mounted and fastened on frame C) and frame A can be moved back and forth with little effort.

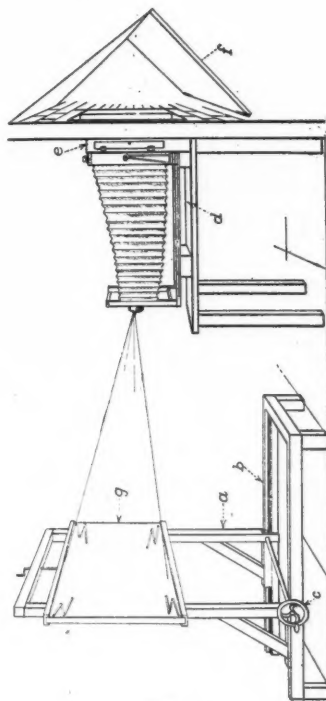


FIG. 5.

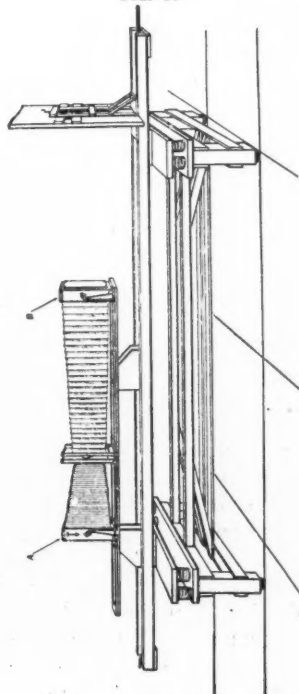


FIG. 6.

A specially designed apparatus for producing bromide enlargements with daylight is shown in Fig. 6, its construction being not dissimilar to that of Fig. 1. The stand *a* is made adjustable and can be moved back and forth on bed *b* by means of hand wheel *c*. The camera is mounted on platform *d* so that the back fits tightly in aperture *e*. A reflector *f* is located at a 45 degree angle to reflect the light into aperture *e*, from which it passes through the negative, reflecting the image on sensitized paper mounted on board *g*. With the frame *a* adjustable, it is possible to produce any size enlargement, although an 18 by 22 in. size has been found large enough for most requirements. With this arrangement it is understood, of course, that no light falls on the sensitized paper except that which forms the image, the room otherwise being in total darkness.

In the production of photos for the company there is need for many power-house views showing installations of air compressors, and underground photographs showing drills and other machines in operation in tunnels, subways and coal and metal mines. Underground photography presents many obstacles foreign to any other field, but while special apparatus has sometimes been found necessary, in a general way the only equipment needed is a good camera outfit and flashlight apparatus.

Lantern slides for use in lecture work such as the presentation of the subject of pneumatic tools in foundries and other industries are made in the copy room on a camera frame illustrated in Fig. 5. Two cameras, A and B, are placed on the frame with the fronts adjoining. The lens is mounted on camera A which is fitted with a special detachable back for holding the lantern slide plate holder. The 8x10-in. negative is placed in the back of camera B. Directly back of this and far enough away to be out of the focal range the copy board C reflects a uniform light on the negative from a white cardboard tacked to it. By proper manipulation of the two cameras the negative image is reduced and converted into a positive lantern-slide transparency.

In Fig. 3 is shown the washroom of the photographic department where prints are washed, dried and trimmed. The washline apparatus mounted on the two poles will conveniently accommodate 200 8x10-in. prints if they are pinned on the line back to back.

COMPRESSED AIR FOR COOLING IN DRILLING DEEP HOLES IN STEEL

It is generally recognized that compressed air can be used as a cooling medium for drilling cast iron, but there are few mechanics who would advocate its use for machine steel. It may be interesting, therefore, to record an application of compressed air to deep hole drilling in machine steel, which is being put into use in the plant of the Dayton Motor Car Co., Dayton, Ohio.

The piece to be drilled is a piston pin made from round bar stock containing from 0.20 to 0.30 per cent. carbon. This piston pin is machined in a 1¼-inch Cleveland automatic screw machine, which is fitted up with the regular oil feed arrangement for the turret tools, but instead of forcing oil through the piping, compressed air of 75 pounds gage pressure is used.

The drill used is a regular fluted high-speed steel oil-tube drill, ground on the cutting edges so as to break up the chips. A long curling chip would be difficult to remove, as it would twist around the flutes of the drill. The most interesting point about this operation is that the drill is not withdrawn from the work until it has been forced in the desired distance—5 inches—at a steady feed of 0.015 inch per revolution, and a surface speed of about 70 feet per minute. This surface speed is much lower than that which a high-speed steel drill will stand, but it has been found that a heavy feed with a lower surface speed gives the best results, as it produces a chip which is easily blown out.

The chips which are blown out by the compressed air are quite cool and can easily be held in the hand. The hole produced is smooth as compared with that obtained when oil is used as a lubricant. A good grade of lard oil was used on this job before compressed air was tried, but the oil proved unsatisfactory as the drill would bind and heat up before the lubricant reached the bottom of the hole. It seems that the oil made the chips adhere to each other and thus prevented them from being washed out of the hole, while on the other hand the chips are kept clean and cool by the compressed air and are blown out just as soon as they are removed by the drill.—*Machinery*.

FOAM AS A GASOLINE FIRE EXTINGUISHER

Water, it is well known, serves only to increase a fire in petroleum products, although it is effective against alcohol fires. Exclusion of air is the only means of effectively extinguishing an incipient blaze in gasoline, benzine or oil. In the method invented by Laurent in Germany, which has recently been officially tested, the agent employed is foam. A solution of sodium carbonate mixed with foam-producing substances, and a solution of alum, combined in equal parts, produce, without precipitation of any solid, a thick, yellowish-white foam, which can be pumped and sprayed as effectively as water. A mixture of one litre (0.264 gallon) of each of the solutions produces 15 litres (3.96 gal.) of foam weighing 140 grammes per litre (18.6 ounces per gallon). Sprayed on a burning liquid, the foam, as it accumulates, spreads gradually over the whole burning surface, effectively shutting out the air and thus extinguishing the fire. As to its efficiency in extinguishing fires, two typical results of the tests may be quoted. A fierce blaze in a tank of benzine 40.35 sq. ft. in area and 20 in. deep, was extinguished in 78 sec. In another case, with a larger expenditure of chemicals, only 13 seconds were required to quench a fire in another tank 6.56 ft. in diameter and 8.5 ft. deep.

FOR THE ELECTRIC APPLICATION OF AIR BRAKES

At the January meeting of the New York Railroad Club, a paper was presented advocating the use of an electrically controlled air brake for steam railway service. While special emphasis was placed on the greater rapidity of application that can be obtained at the rear of a long train, by means of such a control, the advantages to be gained were not considered to be those of decreasing the distance run in making the stop, but in the reduction of the shock incident to the present method of brake application, because of the greater uniformity in the retardation of all the cars of the train. The first advantage to be gained would, therefore, lie in the elimination of rough stops. Then, as shocks are decreased, so would be the tendency of the wheels to slide flat. The discussion was directed more particularly to passenger train work, but the use of such a brake on freight trains also was advocated on the

ground that there would be a great reduction in shock, and consequently in damage to cars and lading, if the time of application of brakes to the last car of a 100-car train were to be cut down to a simultaneous application to all of the cars from the present required time of 6 or 7 seconds.

NOTES

At the meeting of the American Society of Agricultural Engineers, Eugene Becker brought out the fact that explosive mixtures of gas and air are formed as follows: Gasoline vapor 2 to 5 per cent., air 98 to 95 per cent.; acetylene 2 to 49 per cent., air 98 to 51 per cent.; blow-gas 4 to 8 per cent., air 96 to 92 per cent.; which shows why great care must be exercised in handling acetylene gas to avoid explosions.

A suspension bridge much longer than any yet erected is proposed to span the Mersey at Liverpool. The main dimensions are as follows: Main span, 2,700 ft.; towers, 500 ft. high; height above high-water mark, 200 ft.; depth of girders, 50 ft.; weight of girders, 2,100 tons; width between girders, 50 ft.; width between towers, 300 ft.; and weight of cables (410 sq.in. in each), 6,400 tons.

Two horses weighing 1,600 pounds each, together pulled 3,750 pounds or 550 pounds more than their combined weight. One elephant weighing 12,000 pounds pulled 8,750 pounds or 2,250 pounds less than its weight. Fifty men, aggregating 7,500 pounds in weight, pulled 8,750 pounds, or just as much as the single elephant; but, like the horses, they pulled more than their own weight. One hundred men pulled 12,000 pounds.

Forty minutes after they had been declared dead from suffocation seven out of twelve firemen recently overcome by smoke and gas during the destruction of the Westinghouse electric plant by fire in Pittsburgh, Pa., were revived by pulmotors at a hospital, and owe their lives to this life-saving invention. The Bureau of Mines has a full equipment of pulmotors for its life-saving crew, and they proved successful in many instances.

Some large turbo-compressors are now in successful operation in Germany. One of these installed at the Reden mine, near Saarbrücken,

runs at 4,200 r. p. m. and compresses over 4,000 cu. ft. of free air per min. to 90 lbs. gage. Another, installed in Westphalia, runs at the same speed with a capacity of 6,000 cu. ft. of free air per min. delivered at a pressure of 105 lbs. gage. The efficiency of the compressor, compared with isothermal varies between 64 and 65 per cent.

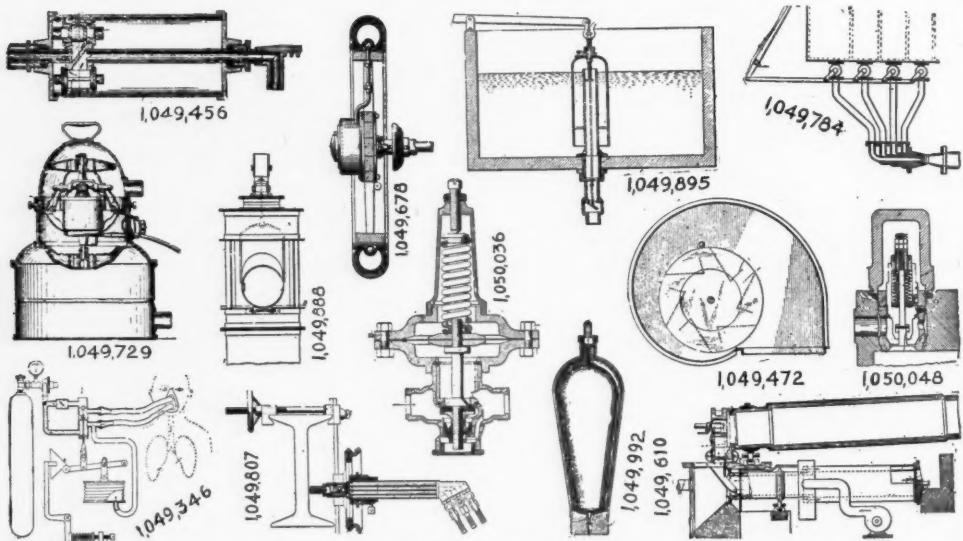
A current of dry air will evaporate and absorb water at any natural temperature, the only condition being that the dry air be renewed as fast as it becomes saturated. Solid water—ice—will evaporate in a current of dry air although the temperature may be below the melting point of ice.

LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

JANUARY 7.

- 1,049,346. ARTIFICIAL BREATHING APPARATUS. JOHANN HEINRICH DRAGER, Lubbeck, Germany.
 1,049,443. PNEUMATIC PIANO - PLAYER. FLOYD W. BORDNER, Toledo, Ohio.
 1,049,456. RECIPROCATING FLUID-PRESSURE MOTOR. PETER T. COFFIELD, Dayton, Ohio.
 1,049,472. FAN OR BLOWER. HENRY P. GALE, Chicago, Ill.
 1,049,610. ROTARY COOLER FOR CEMENT CLINKER. AXEL SCHAEFFER, Copenhagen, Denmark.
 1,049,677-8. COOLING DEVICE FOR PNEUMATIC TIRES. ANDREW B. CRAIG, Tarkio, Mo.



PNEUMATIC PATENTS, JANUARY 7.

Systematic water waste surveys conducted in Chicago, Memphis, Yonkers, Indianapolis, Washington and New York City have brought to light an immense number of underground leaks running continually into nearby sewers, without showing at the surface. In the city of Washington alone, in the past five years, a total of 30,000,000 gallons daily from about 3,000 underground leaks were found, chiefly in mains and service pipes, none of which showed above the ground. A new water supply of this amount would have cost \$5,000,000, plus extra operating expenses for the new plant, while the stopping of these leaks actually reduced the operating charges.

- 1,049,729. SUCTION-CREATING PUMP FOR CLEANING AND SCRUBBING MACHINES. CHARLES A. KAISER, Philadelphia, Pa.
 1,049,784. ELASTIC-FLUID TURBINE. PAUL WAGNER, Charlottenburg, Germany.
 1,049,807. ROTARY - BLOWPIPE APPARATUS. WORTHY C. BUCKNAM, Jersey City, N. J.

1. In a device for the circular cutting of beams, rails and other bars by means of gases, the combination of a supporting structure having suitable means for attachment to the bar, a circular carrier supported thereby and having transverse holding and guiding means, means for rotating said carrier, and gas cutting means on said carrier adjustable relatively to the axis of rotation on said holding and guiding means.

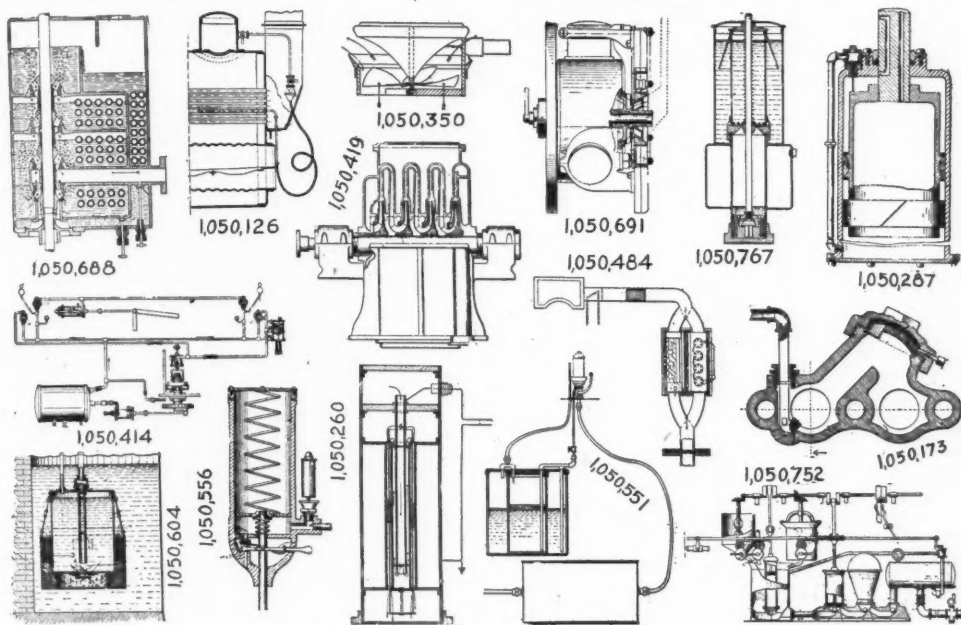
- 1,049,888. AIR-LOCK FOR CAISSONS. SAMUEL MATTSON, New York, N. Y.

2. An air lock for caissons consisting of a cylindrical casing having an opening in its side, and a concave roller mounted on said casing at the bottom of said opening, for the purpose stated.

- 1,049,895. SIPHON FLUSHING APPARATUS JOHN J. MEYER, Yonkers, N. Y.
 1,049,992. AUTOMATIC AIR-VALVE. BOB CATCHINGS, Jasper, Ala.
 1,050,013. APPARATUS FOR TREATING GASES AND VAPORS TO THE ACTION OF LIQUIDS. CHARLES HOWARD FOWLER and EDWARD ARNOLD MEDLEY, Great Crosby, England.
 1,050,036. FLUID-PRESSURE REDUCER OR REGULATOR. HENRY MUELLER, deceased, Decatur, Ill.
 1,050,048. COMPRESSOR-VALVE. WILSON A. ZIMMER, Cleveland, Ohio.

JANUARY 14.

- 1,050,126. FLUID-JET BLOWER. TEODORO GRUENWALD, Genoa, Italy.
 1,050,173-4. SANDER. WALTER B. ROGERS, Knoxville, Tenn.
 1,050,260. OZONE-GENERATOR. ALBERT E. WALDEN, Baltimore, Md.



PNEUMATIC PATENTS, JANUARY 14.

- 1,050,287. AIR-CYLINDER. JOHN J. OLSON, Superior, Wis.
 1,050,350. ANEMOMETER. HENRY DAVIS, Derby, England.
 1,050,372. ELECTRIC AIR-HEATING DEVICE. FRANK P. MIES, Chicago, Ill.
 1,050,414. AIR-BRAKE AND APPURTENANCES FOR VEHICLES. EDWARD W. WOOLLEY, Jersey City, N. J.
 1,050,419. CENTRIFUGAL COMPRESSOR. OTTO BANNER, Easton, Pa.
 1,050,484. AIR-TEMPERING DEVICE. MIN DE LIN MCGERRY and FRANK P. MIES, Chicago, Ill.
 1,050,551. VISUAL SIGNAL. STEPHEN J. KUBEL, Washington, D. C.

1. In a signal means, the combination of an audible signal, a tube arranged adjacent thereto and disposed to discharge upward, a source of fluid-pressure supply, containers, a conduit intermediate the containers and said tube, chemicals in said containers, adapted when commingled to form a signal-means visible in the atmosphere, a conduit intermediate the source of fluid-pressure supply and the audible signal, a wave con-

trolling the passage of fluid-pressure through said conduit, and a conduit leading from the second named conduit, at the opposite side of the valve with reference to the source of fluid-pressure supply, to the interiors of the containers, whereby opening of the valve will cause sounding of the audible signal and a synchronous emission of visual-signal means from the tube.

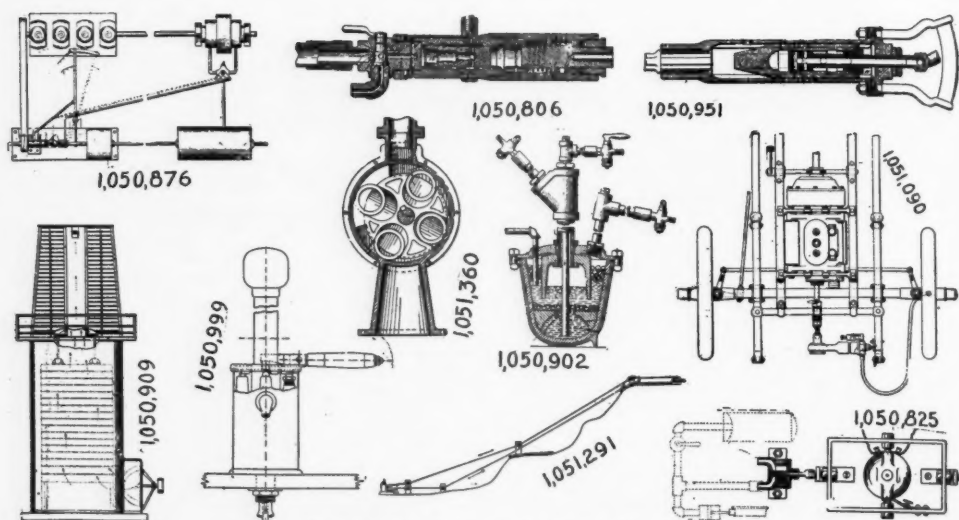
- 1,050,556. FLUID-PRESSURE-RELEASEABLE LOCK FOR FREIGHT-CAR DOORS. GEORGE VANCE MCGILL, Albion, Pa.
 1,050,604. AIR-LIFT FILTERING-PUMP. CONRAD E. BIEL, Denver, Colo.
 1,050,688. ROTARY AIR-PUMP. JOSEPH PETERMOLLER, Holm Foundry, Cathcart, Scotland.
 1,050,691. FLUID-PRESSURE ENGINE OR PUMP. CHARLES BENJAMIN REDRUP, Canton, Cardiff, England.
 1,050,752. MEANS FOR SUPPLYING A SPRAYING FLUID UNDER PRESSURE. ROBERT MURTON POOLE, Mount Gambier, South Australia, Australia.

- 1,050,767. AIR-PUMP. HENRY ALBERT FLEUSS, Thatcham, England.

JANUARY 21.

- 1,050,806. ROTATOR FOR ROCK-DRILLS. CHARLES T. CARNAHAN, Denver, Colo.
 1,050,825. AUTOMATIC AIR-BRAKE CONTROL. MAX K. GROSSHEIM, Jersey City, N. J.
 1,050,876. FLUID-PRESSURE SYSTEM AND AUTOMATIC GOVERNOR THEREFOR. FRED S. VAUGHN, Chicago, Ill.
 1,050,892. BLOWER. EDGAR C. WILEY, Lynchburg, Va.
 1,050,902. ECONOMIC METHOD OF OBTAINING GASES. CHARLES E. ACKER, Ossining, N. Y.

1. The process of obtaining a gaseous element from a fluid containing oxygen as one of the constituents thereof, which comprises reacting upon a heated mass of metal, having a strong affinity for oxygen, with the oxygen content of a quantity of said fluid, separating the element sought from the compound so formed, disseminating said compound through a mass of liquid



PNEUMATIC PATENTS, JANUARY 21.

conveying medium having characteristics different from those of said compound, conveying said compound through the instrumentality of said medium to points relatively remote from where said gaseous element is being separated in manner aforesaid, and reacting at said remote points upon said compound with a reducing reagent to reform the metal.

1,050,909. LIQUID-COOLING APPARATUS. FERDINAND BAUER, St. Louis, Mo.

1,050,951. PNEUMATIC HAMMER. VILHELM PHILIP KESSEL, San Francisco, Cal.

1,050,999. APPARATUS FOR AERATING LIQUIDS. HUBERT PEARCE, Wanstead, and WILLIAM BARRATT, Muswell Hill, England.

1,051,090. AIR-PUMP FOR INFLATING AUTOMOBILE-TIRES. JOHN DESMOND, Chicago, Ill.

1,051,291. PNEUMATIC SNUBBING MEANS. HARRY L. TURNER, Portland, Oreg., and HENRY A. KALB, Ramond, Wash.

1. In a snubbing device, the combination with the two drums of a hauling engine; of a pneumatic means for controlling the speed of the device; and a single hauling cable having one end fixed on one of said drums, from which it extends to a sheave of said controlling means, making a few turns around said sheave and thereupon returning to the second drum of said hoisting engine.

1,051,304. PNEUMATIC ACTION. CHRISTIAN ALTER, New York, N. Y.

1,051,360. AIR-PUMP. GEORGE P. WISDOM, Denver, Colo.

JANUARY 28.

1,051,406. EXHAUST-REGULATING VALVE FOR PNEUMATIC PLAYER-ACTIONS. EMORY C. HISCOCK, Chicago, Ill.

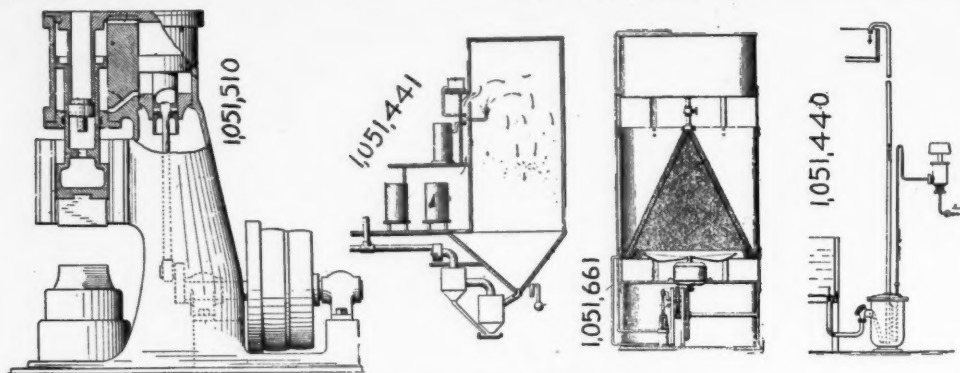
1,051,441. OBTAINING DRY SOLIDS FROM LIQUID SUBSTANCES. GEORGE H. PALT-RIDGE, Washington, D. C.

1. A process for drying liquid substances, which consists in supplying air to an air chamber, spraying atomized fluid into the upper part of the chamber and permitting it to drop downward while being dried by the air, and in discharging the entire air, vapor and solid contents of the chamber together at the same point in the bottom of the chamber.

1,051,510. FLUID-POWER HAMMER. JOHN NAZEL and RALPH E. BATES, Philadelphia, Pa.

1,051,540. COMPRESSED-AIR DISTRIBUTING OR REGULATING DEVICE FOR PULSOMETERS AND SIMILAR APPARATUS. JOHANN BERNING, Dusseldorf, Germany.

1,051,661. AIR-COOLER. ALBERT ANDERSON, Deer Wood, Minn.



PNEUMATIC PATENTS, JANUARY 28.